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(54) Title: GENERAL INFORMATION MANAGEMENT SYSTEM
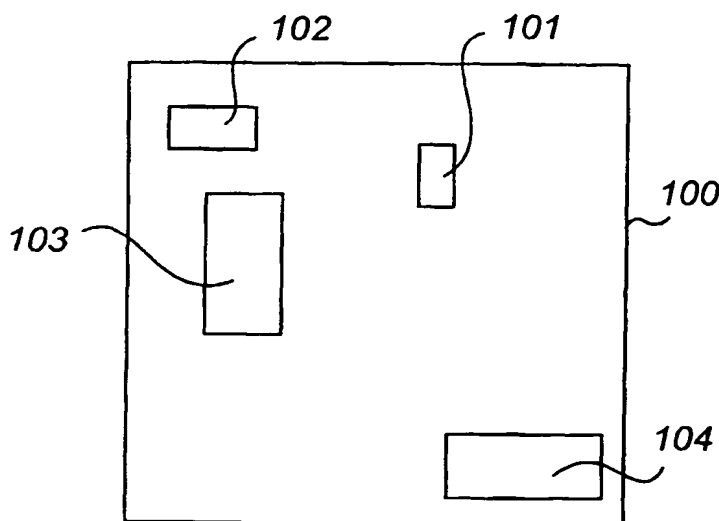
(57) Abstract: An information management system is intended for management of digitally represented information which is associated with absolute positions on an imaginary surface (200). The imaginary surface (200) contains at least two regions (201-208), each of which is dedicated to predetermined management of the digitally represented information. In the system the management of the digitally represented information is carried out on the basis of the region affiliation of the absolute positions associated with the information. The system is suitably based on use of a position-coding pattern which defines the imaginary surface (200) and which in parts is applicable on different bases. The system makes possible both digital recording of information and control of how the information thus recorded is to be managed. A database, a method for management of information, a method for compiling a pattern layout, a product and use are also described.

WO 01/48685 A1

GENERAL INFORMATION MANAGEMENT SYSTEM

FIELD OF THE INVENTION

This invention relates to the field of management and communication of information.

BACKGROUND OF THE INVENTION

5   Information is often written down and communicated by means of pen and paper. Such paper-based information is, however, difficult to manage and communicate efficiently.

Computers are used to an increasing extent for
10   managing and communicating information. The information is entered by means of a keyboard and stored in the computer's memory, for example on a hard disk. The entry of the information by means of the keyboard is, however, slow and it is easy to make mistakes. Nor is it particu-
15   larly convenient to read large amounts of text on a computer screen. Graphical information, such as drawings or images, is usually entered by means of a separate image reader, such as a scanner or the like, in a procedure which is time-consuming, cumbersome, and as often as not
20   gives unsatisfactory results. However, once the information is in the computer, it is easy to communicate it to others, for example as an e-mail or SMS via an Internet connection or as a fax via a fax modem.

In Applicant's Patent Application PCT/SE00/01895,
25   which claims priority from Swedish Patent Application No. 9903541-2, filed on 1 October 1999, and which is incorporated herewith by reference, a system is described where a pen and paper are used to write down information in the traditional way, while at the same time a
30   digital graph is created consisting of several tracks or lines of the movement of the pen across the paper, which graph can be transmitted to a computer. Such a system combines the advantage of management with pen and paper, which many users are used to, with the computer's supe-

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rior ability to communicate and store information. The
sheet of paper is provided with a coding pattern, for
example consisting of dots or other symbols. The pen has
a sensor, preferably optical, which records the coding
5   pattern and, by means of a mathematical algorithm, calcu-
lates the position of the pen on the coding pattern.

In this way, the traditional pen becomes an excel-
lent input device for the computer, and the computer can
be used to store the recorded information instead of the
10   sheet of paper having to be archived in a file. In addi-
tion, the information can easily be communicated by means
of the computer.

The recorded information contains parts which can be
used for different purposes.

15   1) The digital graph contains an image, such as
figures or interrelated lines, which can be interpreted
by people, for example letters, a symbol, a figure or a
drawing. This is the actual message which was written
down and which the user wants to manage in some way, for
20   example to archive or to send to a recipient. This infor-
mation, so-called message information, is stored in some
graphical format, for example a vector format or as a
collection of pixels.

2) The part of the message information which con-
25   sists of letters (handwritten) can be subjected to sub-
sequent processing in the form of OCR interpretation
(Optical Character Recognition) or ICR interpretation
(Intelligent Character Recognition) for conversion into
a character format which can be used by the computer, for
30   example for searching purposes or for cataloguing. Sym-
bols can also be interpreted, for example stenography
symbols or icons, to which the user predefines a particu-
lar meaning. In the following, this information is called
character information.

35   3) The information can also contain an identifica-
tion of which pen was used to write down the information.

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4) Finally, the graph contains information about where on the surface the graph was written down, so-called absolute position information.

5) In addition, a hard copy of the recorded information can be obtained, if the pen makes physical marks on the sheet of paper.

Prior-art technique comprises other systems for obtaining absolute or relative position information when writing on a surface. However, these previously known systems only describe the use of such information in order to create message information and/or character information, that is information belonging to the groups 1) and 2) above. Such prior art includes, for example, optical detection of a position-coding pattern on a base according to US-A-5,051,736, US-A-5,442,147, US-A 5,852,434, US-A-5,652,412 and EP-B-0 615 209. Position information can also, as also described in EP-B-0 615 209, be obtained by means of acceleration sensors, or by means of inductive/capacitive/magnetic sensors. Other alternatives are a base incorporating pressure sensors, as described in US-A-5,790,105, triangulation of signals (light, sound, infrared radiation, etc.) with the use of a plurality of transmitters/receivers, as described in US-A-5,012,049, or mechanical detection of movement relative to a surface, as described in US-A-4,495,646. Position information can also be obtained by combinations of techniques. For example, a system is described in WO 00/31682 with combined optical detection of symbols for the determination of absolute position information at low resolution, and acceleration sensors, for the determination of relative position information at high resolution.

Although, according to prior art, there are several different techniques for recording message and/or character information as described above, there is no system for enabling the user to manage this information in a simple, flexible and structured way.

Known systems for managing information, such as the
database system as described in US-A-5,842,196, comprise
as a rule a central server unit and user units in the
form of personal computers or terminals, which communi-
5   cate with the server unit. The server unit contains a
database with information stored in data records. Search-
ing these data records and updating the same with new
information, are time-consuming operations which should
be made as efficient as possible. For this reason the
10   database is often organised in a tree structure, in which
the data records, or data fields in these, are given
searchable indices or key values. It is, however, unclear
how this type of database system would be able to be
combined successfully with the techniques for recording
15   message and/or character information described above.

US-A-5,932,863 describes a technique for improving
the user interface to electronic media. Paper products
are provided with a machine-readable symbol, which is
allocated a pre-programmed command in a computer. When
20   a user reads in the symbol by means of a hand-held
scanner, this is transmitted to the computer, where the
pre-programmed command is executed, for example to cause
the computer to retrieve interactive software from a cen-
tral databank and to execute this on the computer. Also
25   in this case, it is unclear how this type of user inter-
face would be able to be combined with the techniques for
recording message and/or character information described
above.

SUMMARY OF THE INVENTION
30   This invention relates to improving management of
information which is recorded by means of a user unit.
More specifically, it is an object of this invention to
increase the possibilities of managing digitally-recorded
information.

35   It is also desirable to show a technique for infor-
mation management that is easy for the user to use.

A further object is to provide a technique which
enables rapid, simple and unambiguous management of
information.

It is also an object to provide a technique which
5   is general, but which permits individual handling of
different parties' information.

These and other objects, which will be apparent from
the following description, have now been achieved com-
pletely or partially by an information management system
10   according to claims 1 and 12, a database according to
claim 22, a method for information management according
to claims 31 and 37, a method for compiling a pattern
layout according to claim 41, a product according to
claim 47 and use according to claim 50. The dependent
15   claims define preferred embodiments.

According to a first aspect, the invention relates
to an information management system.

According to prior-art technique, a position-coding
pattern is used locally for the sole purpose of recording
20   handwritten information. The position-coding pattern then
needs only to be used to code positions locally on the
writing surface on which the information is written.
According to the invention, absolute positions are used
instead on an imaginary surface which is made up of all
25   the points or positions which can be coded by means of
the position-coding pattern. Each position is defined by
at least two coordinates. If there are several imaginary
surfaces, a third coordinate can be used to define which
imaginary surface is in question. By dedicating different
30   parts of the imaginary surface to different types of
information management, it is possible both to record
information and to control how the information is to be
managed by using the position-coding pattern. Different
bases are thus provided with different subsets of the
35   position-coding pattern, depending upon how the informa-
tion which is written on the base is to be managed.

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The position-coding pattern covers a total surface
which is imaginary in as much as it is very large and is
therefore never present in its entirety on a base. The
imaginary surface is an imaginary surface which is made
5   up by all the positions that the position-coding pattern
can code. The imaginary surface can be divided into main
regions, which in turn can be divided into subregions,
which in turn can be divided into further subregions,
etc. The main regions can be different sizes and shapes.
10   Together they do not need to cover all of the imaginary
surface, but they can do so. Each main region can be
dedicated to a particular type of information manage-
ment. The above-mentioned subregions can be dedicated
to variants of the information management to which the
15   associated main region is dedicated. The subregions can
also be dedicated to different parties, products, ser-
vices, operations on recorded information or the like.
It must be pointed out that not all of the informa-
tion which is managed in the system needs to be repre-
20   sented by absolute positions on the imaginary surface.
The information can be recorded by a combination of
techniques, of which one identifies absolute positions
and the other identifies relative positions. An example
of such a combination is given in the above-mentioned
25   WO 00/31682. In this case, the information may contain
only one or a few absolute positions, and a sequence of
local positions related to these absolute positions. As
the local positions can be converted to absolute posi-
tions, such digitally represented information which is
30   linked in some way to absolute positions on an imaginary
surface can also be managed in the system according to
the invention.
The system thus increases the possibilities of
managing information. A user can write down and at the
35   same time digitally record information on a position-
coding pattern. The management of the information
recorded digitally in this way is then controlled by

where on the imaginary surface the information is record-
ed. The system thus permits information gathering, that
is digital recording of information which is written down
on a writing surface or the like, and information distri-
5   bution, that is communication of information to and from
a user. All or parts of the digitally recorded informa-
tion, for example in the form of message information, can
be sent to a recipient. Alternatively, a user can be sent
further information from a particular party, for example
10   about a product or service, by recording information on a
part of the imaginary surface designed for the purpose.
        The system is thus easy to use, as the user does not
himself need to define in each situation how the recorded
information is to be managed. The management is control-
15   led instead by the coordinates of the recorded informa-
tion, that is its region affiliation on the imaginary
surface. The user can work largely as he does at present
with paper and pen, but still make use of all the possi-
bilities of electronics. The recorded information can be
20   managed quickly, easily, unambiguously and transparently
for the user in the system according to the invention.
        The system according to the invention is general,
but permits individual handling of different parties'
information, thanks to the fact that different parties
25   with different needs can be given access to different
regions on the imaginary surface in the system and can
control how their own information is to be managed.
        As an example, it can be mentioned that a main
region can be dedicated to information which is to be
30   sent to a predetermined address in a computer network.
        As another example, it can be mentioned than another
main region can be dedicated to information in the form
of notes which are to be stored in a user's computer.
        Different regions on the imaginary surface can be
35   dedicated to different purposes for different periods of
time. Different regions can be reserved by a party for

different periods of time, for special markets and for
special applications.

The system can be called global, in that the divi-
sion of the imaginary surface into different unique

5   regions is applied throughout the whole system, which,
however, does not need to be global in the sense that it
is world-wide.

The global information management system can be said
to arise and exist when any party utilises the property

10   of a position-coding pattern that different coordinate
areas or regions which are coded by different subsets of
the pattern can be dedicated to different management of
information purposes.

In a preferred embodiment, the information manage-

15   ment system comprises a computer system which stores
information about the position of the different regions
on the imaginary surface. The computer system can com-
prise one or more computers which store the above-men-
tioned information. What is essential is to keep track

20   in a coordinated way of where the different regions are
located so that the regions are utilised consistently in
the system. Information is also suitably stored concern-
ing unused or unreserved regions and concerning what the
different reserved regions are dedicated to.

25   In one embodiment, at least one command region which
represents an operation is defined on the imaginary sur-
face, so that detection of the absolute coordinates for
a point within this command region results in the initia-
tion, and later execution, of said operation.

30   In addition to the regions which are dedicated to
different management of information purposes, there can
thus be one or more command regions on the imaginary sur-
face. The former regions are used to record information
which is processed in different ways depending upon the

35   region. The command region is used principally not for
recording information but to define a command or an ope-
ration which is to be carried out. The command region can

in the extreme case comprise a single point, as the com-
mand region does not need to make possible recording of
handwritten information. In the normal case, however, the
command region comprises a plurality of points on the
5   imaginary surface for a corresponding subset of the posi-
tion-coding pattern to be read off with high reliability.
The command or operation is typically intended to be car-
ried out with regard to information which has been or
which is to be recorded by means of a subset of the posi-
10 tion-coding pattern which codes one of said regions which
are dedicated to different management of information pur-
poses.

According to one example, a user writes information
on a notepad, the writing surface of which has a writing
15 field provided with a first subset of the position-coding
pattern, which first subset codes coordinates within a
region on the imaginary surface dedicated to notes.
Thereafter the user records absolute coordinates from a
command region, which is coded by a second subset of the
20 position-coding pattern, which second subset is reproduc-
ed in a box on the writing surface of the notepad. The
command can, for example, be to store the recorded infor-
mation in the user's computer, in which case the box is
marked "store". As will be described in greater detail
25 below, the detection of the second subset of the posi-
tion-coding pattern results in the information written on
the first subset being stored in the user's computer.

What was described above regarding the regions for
information management also applies to the command
30 regions.

The command region can be a universal region on the
imaginary surface, that is a corresponding subset of the
position-coding pattern can be applied on a number of
different bases and combined with other subsets of the
35 position-coding pattern associated with other regions on
the imaginary surface.

Alternatively, the command region can be part of one of the above-mentioned regions for information management, for example, a primary region which is dedicated to transmission of information to an external unit. The primary region also suitably contains at least one message recording region, which is dedicated to digital recording of a sequence of positions on the imaginary surface. The primary region suitably contains a plurality of identical standard regions, each of which comprises at least one command region and at least one message recording region. The primary region is thus hierarchically structured, which has the advantage that detailed information about this part of the imaginary surface can be stored in compact form, for example as an algorithm-based database. In addition all information which is recorded within a standard region is considered to belong together, which can be an advantage when the recorded information is to be managed in the system.

In a preferred embodiment, the information about the position of said at least one command region on the imaginary surface is stored in the above-mentioned computer system, so that information is collected about where all the different regions on the imaginary surface are positioned and consistent utilisation is made possible.

The command or operation which is defined by the command region can, for example, be one of the commands to store information, to send information or to convert information. The information can be sent in different formats and via different "transport systems". The information can, for example, be sent as an e-mail message, as an SMS or as a fax. It can be sent from a user unit, for example in the form of a digital pen, via for example a mobile phone, a computer or a PDA to a recipient which, for example, can also be a mobile phone, a PDA, a computer, in particular a computer connected to the Internet, or a program in a computer.

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The information is sent preferably in graphical
form, that is as sequences of recorded positions. All
the recorded positions which represent information can be
sent, or they can be processed into a compressed form or
5   some other format. Character recognition can also be car-
ried out, so that the information can be sent in charac-
ter-coded format.

The information can be stored in a unit which is
synchronised with the user unit, for example a computer,
10   or at a storage location on a server connected to the
Internet.

The conversion command can comprise a command which
means that the information, for example, is to be trans-
lated into a predetermined language, subjected to charac-
15   ter-recognition, encrypted, or converted in some other
way.

It does not need to be a single party that adminis-
ters all the information management in the information
management system, but different parties can have access
20   to different regions on the imaginary surface. The party
that is responsible for the information management system
must, however, as mentioned earlier, know which regions
on the imaginary surface are reserved and which are free.
The computer system stores advantageously information
25   about an owner of at least one of said information
management regions.

In addition, the computer system can need to com-
prise information about what particular information
management regions and command regions are dedicated to,
30   so that the computer system can carry out part of the
information management. Particular information which is
represented by coordinates of positions within particular
regions can, for example, always be sent to the computer
system, which can carry out particular processing of the
35   information and then forward it to a recipient.

In a preferred embodiment, the information manage-
ment system can also comprise at least one user unit,

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preferably in the form of a hand-held device, such as
a digital pen, which is arranged to record absolute posi-
tions from a base provided with at least one subset of
said position-coding pattern, which subset can also be
5   regarded as at least one subset of the imaginary surface.

The user unit can comprise a sensor which can detect
the position-coding pattern. As mentioned above, the
information can alternatively be recorded by a combina-
tion of techniques, in which case the user unit can com-
10   prise an additional one or more sensors, for example, an
acceleration sensor, a mechanical translation sensor,
etc.

The user unit can advantageously also have an ordi-
nary pen point, so that information can be written on a
15   base which is provided with a subset of the position-
coding pattern and can at the same time be recorded digi-
tally by the sensor. The information which is recorded by
the user unit in the form of absolute positions thus
usually represents message information, that is graphical
20   information which is written/drawn on the base using the
user unit. However, it can alternatively represent a com-
mand (an operation).

When a command is detected, it causes the user unit
to at least initiate a predetermined operation, possibly
25   however with a certain delay. In certain cases the user
unit can carry out the whole operation itself. In other
cases the user unit can, for example, transfer all or
parts of the recorded information and information about
which operation is to be carried out to an external unit,
30   for example a computer or mobile phone, which completes
the operation. This transmission can be carried out
directly or at a later time. By "initiate" is meant here
that the user unit ensures that the operation is carried
out, even though it does not carry out the operation
35   itself, so that the user does not need to give further
commands to the user unit or the external unit in order
for the operation to be carried out. However, the user

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many need to supply further information or to confirm the
operation/the information. In its simplest embodiment,
the user unit is not able to recognise or interpret the
coordinates corresponding to different command regions,
5   but it ensures that a required operation is carried out
by sending all the coordinates to an external unit which
can interpret them.

The information management system can also advanta-
geously comprise at least one base which is provided with
10   at least one subset of said position-coding pattern. The
base can constitute or be incorporated in a number of
products. Examples of such products are forms, brochures,
newspapers, notepads, calendars, desk mats, etc, of paper
or plastic material, a writing board of plastic material
15   or a display screen. Products which are particularly
suitable for being provided with coordinates are all
forms of products with writing surfaces. The writing
surfaces do not need to be suitable for writing with an
ordinary pen point, but can be writing surfaces on which
20   writing is carried out by the pen being moved as in writ-
ing. The products are provided with different subsets of
the position-coding pattern, depending upon how the
information is to be managed.

According to a second aspect, the invention relates
25   to a database which contains information about the above-
mentioned imaginary surface. In the database at least one
position on the imaginary surface is allocated a rule for
information management, so that information which is
associated with the absolute coordinates for said at
30   least one position is managed on the basis of this rule.

This database can, in the information management
system described above, be stored in its entirety in a
central administration unit and/or be divided between a
plurality of units. Different types of database struc-
35   tures can be used in different units. All types of con-
ventional database structures can be used, for example
relational, network-based, or hierarchical structures. In

a user unit, which generally has limited memory and pro-
cessor capacity, the database structure is preferably
algorithm-based.

The database suitably contains further information
5   associated with positions on the imaginary surface, such
an owner, a recipient address, an encryption instruction,
a link to a program or document file to be executed or to
be sent to a recipient, etc.

The advantages of the database according to the
10 invention are apparent from the above description of the
system.

According to a third aspect, the invention relates
to a method for managing information, the advantages of
which are apparent from the above description of the
15 system.

According to a fourth aspect of the invention, this
relates to a method for compiling a pattern layout which
is intended for application on a product.

The method permits a party or user to create a pat-
20 tern layout that can be used for digital recording and
management of information in a system or method according
to the invention. The advantages of this method are appa-
rent from the above description of the system.

According to a fifth aspect of the invention, this
25 relates to a product which is intended to be used in an
information management system as described above. The
product has a message field which is provided with a
first subset of the position-coding pattern to enable
digital recording of graphical information which is writ-
30 ten on said first subset, and a command field which is
provided with a second subset of the position-coding pat-
tern, which second subset defines an operation which is
to be carried out concerning the recorded graphical
information.

35   The advantages of this product are apparent from the
above description of the system.

According to a sixth aspect of the invention, this
relates to use of positions on at least one imaginary
surface divided into regions for control of management of
information. There is a rule associated with each region
5   for how information which contains the coordinates of at
least one position within the region is to be managed.

The advantages of this use are apparent from the
above description of the system.

BRIEF DESCRIPTION OF THE DRAWINGS

10 This invention and its distinctive features, objects
and advantages will be described in greater detail in the
following with reference to the accompanying drawings,,
which for the purpose of exemplification show currently
preferred embodiments.

15 Fig. 1 is a schematic diagram that shows an informa-
tion management system according to the invention.

Fig. 2 is a schematic diagram that shows a first
imaginary surface with main regions that are dedicated
to different purposes.

20 Fig. 3 is a schematic internal view of a digital pen
which can be used in an information management system
according to the invention.

Fig. 4 is a schematic diagram that shows in greater
detail a second imaginary surface with main regions that
25 are dedicated to different purposes.

Fig. 5 is a schematic diagram that shows in greater
detail subregions in a hierarchically organised main
region on the imaginary surface in Fig. 4.

Fig. 6 is a schematic diagram that shows an example
30 of the layout of the subregions at the lowest level of
the main region in Fig. 5.

Fig. 7 is a schematic diagram that shows a product
which is provided with a position-coding pattern accord-
ing to a preferred embodiment.

35 Fig. 8 is a schematic diagram that shows how the
marks can be designed and positioned in a preferred embo-
diment of the position-coding pattern.

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Fig. 9 is a schematic diagram that shows examples of 4*4 symbols which are used to code a position.

DESCRIPTION OF PREFERRED EMBODIMENTS

By way of introduction, the overall construction of
5   an information management system according to the inven-
tion will be described, with reference to Figs 1 and 2.
Thereafter components which are part of the system will
be described, among other things with reference to
Fig. 3, and a number of examples of applications with
10   reference to Fig. 2. This is followed by examples of
different forms of communication and localised data pro-
cessing in the information management system. Finally, a
more detailed example is given of the layout of the ima-
ginary surface which is part of the information manage-
15   ment system, with reference to Figs 4-6.

Fig. 1 shows an example of how a system according to
the invention can be constructed. The system comprises
principally a plurality of products, a plurality of user
units and one or more external units. For the sake of
20   clarity, however, only one product 1, one user unit 2 and
one external unit 3 are shown in Fig. 1.

The product 1 in Fig. 1 is provided with a message
field 1A to receive graphical information, for example
text, numbers or figures, which are written using the
25   user unit 2, and a command field 1B for initiating/
implementing different operations using the user unit 2.

The system permits structured management of the
information which a user records on the product 1 using
the user unit 2. The product 1 is provided with a posi-
30   tion-coding pattern which is interpreted by the user unit
2 as absolute coordinates on the surface of the product
1. The position-coding pattern, which is described in
greater detail below, is such that it codes positions on
a total surface or imaginary surface which is much larger
35   than the surface of the product 1. When the user passes
the user unit 2 across the surface of the product 1,
information is recorded containing one or more pairs of

absolute coordinates. This recorded information is com-
municated, automatically (on-line) or upon command, to
the external unit 3 for storage and/or processing.

In the system according to the invention, management
5   of the recorded information is dependent upon where on
the imaginary surface the information has been recorded,
that is the coordinate content of the recorded informa-
tion.

This system permits structured processing of infor-
10   mation. Different parties with different needs can have
access to different parts of the imaginary surface and
can control how their own information is to be managed.
The system is general but also permits individual manage-
ment of different parties' information.

15   Fig. 2 shows schematically an example of an imagi-
nary surface 100 which consists of or is made up by all
the points or positions whose absolute coordinates a
position-coding pattern can code.

Four different coordinate areas or main regions
20   101-104 are defined on the imaginary surface 100. The
main regions 101-104 are different sizes and different
shapes. They are spaced from each other and do not over-
lap. The main regions can in turn be divided into sub-
regions (not shown), which in turn can be divided into
25   further subregions, etc.

The main regions can be more or less regular in
shape, not only rectangular as shown in the example, and
the relationship between the size of the main regions and
the size of the imaginary surface can be completely dif-
30   ferent to the one shown. Nor do the regions need to be
separated from each other, but can physically overlap
each other and be defined by mathematical relations or
associations.

The different main regions 101-104 are dedicated
35   to different purposes. In this example, the first main
region 101 can be dedicated to recording notes, the
second main region 102 can be dedicated to recording

calendar information, that is information which is to be
stored associated with a particular time or a particular
interval of time, the third main region 103 can be dedi-
cated to recording handwritten information which is

5   always to be sent to a predetermined server unit on the
Internet and the fourth main region 104 can be dedicated
to one or more specific commands.

    In an actual information management system the num-
ber of dedicated main regions can be much larger.

10   Information about the extent of the imaginary sur-
face and about the location and extent of the different
main regions which have been dedicated to different
information management purposes or different commands,
which are to be carried out with regard to the informa-

15 tion which is managed in the system, is stored completely
or partially in one or more computer systems, for example
the external unit 3 in Fig. 1. Said computer system can
be a passive part of the information management system.
It does not need to carry out any part of the actual

20 information management and thus does not need to be con-
nected to the other units in the information management
system. The computer system is, however, suitably an
interacting part of the information management system,
as will be shown in greater detail below.

25 The Position-Coding Pattern
    The information management system is based, as shown
above, on use of a position-coding pattern. This pattern
can be constructed in various ways, but has the general
property that if an arbitrary part of the pattern of a

30 particular minimum size is recorded, then the position of
this part in the position-coding pattern can be determin-
ed unambiguously.

    The position-coding pattern can be of the type which
is disclosed in the above-mentioned US A-5,852,434, where

35 each position is coded by a specific symbol.
    It is, however, desirable for the position-coding
pattern to be used to record information at high resolu-

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tion and in addition to be used in a system which permits
varied processing of the information. Therefore the pat-
tern should be designed in such a way that it can code a
very large number of positions given by pairs of absolute
5   coordinates. In addition, the position-coding pattern
should be coded graphically in such a way that it does
not dominate or interfere with the visual impression of
the surface of the product. It should also be possible to
detect the position-coding pattern with high reliability.

10   Therefore the position-coding pattern is advanta-
geously of the type which is disclosed in the Published
International Patent Application WO 00/73983 filed on
26 May 2000, or in the International Patent Application
PCT/SE00/01895 filed on 2 October 2000, both applications
15   being assigned to the present Applicant. In these pat-
terns each position is coded by a plurality of symbols or
marks, and each symbol contributes to the coding of seve-
ral positions. The position-coding pattern is constructed
of a small number of types of symbols.

20   An example is shown in PCT/SE00/01085 where a larger
dot represents a "one" and a smaller dot represents a
"zero".

         The currently most preferred pattern is shown in
PCT/SE00/01895, where four different displacements of a
25   dot or mark in relation to a nominal raster point code
four different values. This pattern is constructed of
small dots at a nominal spacing of approximately 0.3 mm.
Any part of the pattern which contains 6 x 6 such dots
defines a pair of absolute coordinates. Each pair of
30   absolute coordinates is thus defined by an approximately
1.8 mm x 1.8 mm large subset of the position-coding pat-
tern. By means of determination of the position of the
6 x 6 dots on the sensor in the user unit which is used
to read off the pattern, an absolute position on the ima-
35   ginary surface can be calculated by interpolation with a
resolution of approximately 0.03 mm. A more complete

description of the position-coding pattern according to
PCT/SE00/01895 is given in the Appendix.

This position-coding pattern is able to code a large
number of absolute positions. As each position is coded
5   by 6 x 6 dots, each of which can have one of four values,
4^{36} positions can be coded, which with the above-mentioned
nominal distance between the dots corresponds to a sur-
face of 4.6 million km^2.

The position-coding pattern can be printed on any
10   base which allows a resolution of approximately 600 dpi.
The base can be any size and shape, depending upon its
planned use. The pattern can be printed by standard off-
set printing technology. Ordinary black carbon-based
printing ink or some other printing ink which absorbs
15   infrared light can advantageously be used. This means
that other inks, including black ink which is not carbon-
based and which does not absorb infrared light, can be
used to superimpose other printing on the position-coding
pattern without interfering with the reading off of this.

20   A surface which is provided with the above-mentioned
pattern printed with a carbon-based black printing ink
will be perceived by the eye as only a pale grey shading
of the surface (1-3% density), which is user-friendly and
aesthetically pleasing.

25   Of course, fewer or more symbols can be used to
define a position than described above, and larger or
smaller distances between the symbols can be used in the
pattern. The examples are only given to show a currently
preferred realisation of the pattern.

30   The position-coding pattern described above can be
applied on all imaginable products on which information
is to be recorded by the recording of coordinates. Exam-
ples of such products are forms, notepads, calendars,
desk mats, writing boards, etc. The products can be dif-
35   ferent materials, such as paper, plastic, etc. Alterna-
tively the position-coding pattern can be integrated into
or arranged upon a computer screen. As a result, diffe-

rent positions on the screen can be read off by means of
a digital pen which detects the pattern. In this way a
screen is provided with the same function as a touch
screen, but with the advantages that it is unaffected by
5   the environment and that the screen can be bent. The
position-coding pattern can alternatively be displayed
electronically on a computer screen. The currently most
preferred embodiment is, however, that the pattern is
applied onto paper.

10   The User Unit
        Fig. 3 shows an example of a user unit, which in
a preferred embodiment is used to record electronically
graphical information which is produced on a writing sur-
face and to initiate/execute commands or operations on
15   this information.
        The user unit comprises a casing 11 which is the
same shape as a pen. A short side of the casing defines
an opening 12 and is intended to be held in contact with
or a short distance from a base provided with a position-
20   coding pattern.
        The user unit, below called a digital pen, contains
essentially an optics part, an electronic circuitry part
and a power supply.
        The optics part forms a digital camera and comprises
25   at least one infrared light-emitting diode 13 for illumi-
nating the surface which is to be imaged and a light-sen-
sitive area sensor 14, for example a CCD or CMOS sensor,
for recording a two-dimensional image. The pen may also
contain a lens system (not shown). The infrared light is
30   absorbed by the symbols in the position-coding pattern
and in this way makes them visible to the sensor 14. The
sensor records advantageously at least 100 images per
second.
        The power supply for the pen is obtained from a bat-
35   tery 15 which is mounted in a separate compartment in the
casing. Alternatively, however, the pen can be connected
to an external power source.

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The electronic circuitry part comprises a signal
processor 16 for determining a position on the basis of
the image recorded by the sensor 14 and more specifically
a processor unit with a microprocessor which is program-
med to read in images from the sensor and to determine in
real time absolute coordinates for points on the imagi-
nary surface on the basis of the imaged subset of the
position-coding pattern. In an alternative embodiment,
the signal processor 16 is realised as an ASIC (Applica-
tion Specific Integrated Circuit) or an FPGA (Field Pro-
grammable Gate Array).

The position determination is thus carried out by
the signal processor 16, which thus must have software
to enable it to locate and decode the symbols in an image
and to enable it to determine positions from the codes
thus obtained. A person skilled in the art would be able
to design such software from the description in the
above-mentioned Patent Applications WO 00/73983 and
PCT/SE00/01895.

The signal processor 16 can also have limited infor-
mation about the different regions of the imaginary sur-
face and about what these are dedicated to. The signal
processor 16 can, for example, advantageously contain
information which makes it possible for it to recognise
that certain points or regions on the imaginary surface
represent certain commands or operations which are to be
initiated and/or implemented, for example with regard to
information which has been or will be recorded. Preferred
commands which can be recognised by the pen are "store",
"send", "to do", "address" and other similar basic com-
mands. The pen has advantageously indicating means (not
shown), for example a light-emitting diode, a buzzer or
a vibrator, which gives a signal when the pen detects a
command. The signal serves to make the user aware that a
command has been recorded. Of course these indicating
means can also be used to give an indication that the pen
has recorded handwritten information.

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The pen can advantageously also contain information which makes it possible for it to distinguish between, for example, information which is to be stored in the pen, information which is to be transferred to the user's
5   personal computer, information which is to be sent to a fax number via a modem and information which is to be sent to a server at a predetermined IP address.

More specifically, as described above, a main region on the imaginary surface can be dedicated in order that
10   information which is recorded by means of a subset of the position-coding pattern which corresponds to this main region, and is thus represented by coordinates for points which lie within the main region will always to be sent to said IP address for further management.

15   The digital pen comprises in this embodiment a pen point 17, using which the user can carry out ordinary pigment-based writing on the surface provided with the position-coding pattern. The pen point 17 can be extended and retracted so that the user can control whether or not
20   it is to be used. A button (not shown) for extending and retracting the pen point, in the same way as in an ordinary ball-point pen, can also function as an on/off button for the pen, so that the pen is activated when the pen point is extended.

25   The digital pen can also comprise buttons 18 by which it is activated and controlled. It also has a transceiver 19 for short-distance wireless transmission, for example using infrared light or radio waves, of information to and from the pen. In the currently most
30   preferred embodiment the transceiver 19 is a Bluetooth® transceiver.

The digital pen is also suitably provided with a pressure sensor 20 which measures the pressure on the pen point 17 when this is used.

35   The signal processor 16 can comprise software which determines the angle between the pen point and the paper and also the rotation of the pen on the basis of the

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recorded images. Software for this purpose is described
in Applicant's Swedish Patent Application No. 0000952-2.

In a preferred embodiment, the signal processor 16
determines the following information on the basis of each
5   recorded image: a pair of coordinates, the angle between
the pen and the paper, the rotation of the pen, the pres-
sure on the paper and in addition a time-stamp on the
basis of the time of the recording of the image. Depend-
ing upon how the information management system is con-
10   structed, it can, however, be sufficient to record the
pair of coordinates, possibly together with one of the
other parameters.

The recorded pair of coordinates can be processed
and stored in a compressed format. The signal processor
15   16 can, for example, be programmed to analyse a sequence
of pairs of coordinates and convert these into a train of
polygons which constitutes a description of how the pen
has been moved across the surface which is provided with
the position-coding pattern.

20   All the recorded data can be stored in a buffer
memory 21 awaiting transmission to an external unit. The
digital pen can thereby work in stand-alone mode, that
is the pen sends the information when it has the opportu-
nity, for example when it makes contact with an external
25   unit, whereupon it retrieves recorded information from
the buffer memory 21. It must also be pointed out that
the signal processor 16 does not need to forward all the
information to an external unit, but can be programmed
to analyse the recorded coordinates and only to forward
30   information which is represented by coordinates within a
particular coordinate area. The information can also be
forwarded immediately on-line.

The signal processor 16 can also have software for
encrypting the information which is sent to external
35   units.

The pen can have, but thus does not need to have,
knowledge of what all the different regions on the ima-

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ginary surface are dedicated to. In fact, no individual
unit in the system needs to have this knowledge, but it
can be distributed over a number of different units. For
the administration of the system there should, however,
5   be gathered knowledge of which main regions (and sub-
regions thereof) are already dedicated and which main
regions (and subregions thereof) are free. However, only
the party that at the time has the sole right to use a
particular region (main region or subregion) has informa-
10 tion about its precise use. Of course, as an alternative,
all information can be collected in a central unit, such
as in a memory 3' of the unit 3 in Fig. 1.

It is also desirable for only simpler, less time-
consuming and memory-intensive processing of the recorded
15 information and processing of security-sensitive informa-
tion to be carried out in the pen. More complicated pro-
cessing can be carried out in a local computer, with
which the pen communicates and in which software is
installed for processing information from the pen, and/or
20 in a server unit which can contain very powerful software
for, among other things, character recognition (OCR), a
larger amount of memory, for example for database infor-
mation, and faster signal processors for more advanced
processing of the information.

25   Such distribution of the information processing
makes it possible to manufacture pens at a relatively low
cost. In addition, new applications can be added to the
information management system without the existing pens
needing to be upgraded. Alternatively, the user can
30 update his pen at regular intervals so that it receives
information about new dedicated regions and about how
information which is related to these regions is to be
managed and also new functionality.

The above example is only given to show a currently
35 preferred realisation of the digital pen. In an alterna-
tive embodiment, the pen operates only as an image gene-
rator, that is the images recorded by the sensor 14 are

transmitted to an external unit, for example a computer, which processes the images to determine the coordinates as above, and which communicates if necessary with other external units.

In the embodiment above, the pattern is optically readable and the sensor is thus optical. The pattern can, however, be based on a parameter other than an optical parameter. In such a case the sensor must of course be of a type which can read the parameter concerned. Examples of such parameters are chemical, acoustic or electromagnetic marks. Capacitive or inductive marks can also be used. However, it is preferable for the pattern to be optically readable, as it is then relatively simple to apply it onto different products and in particular onto paper.

Examples of Applications in the Information Management System

In the following, the information management system according to the invention is illustrated by means of a number of examples of applications with reference to the imaginary surface in Fig. 2.

The applications in an information management system according to this invention can be divided into three groups or types: 1) Applications with analogue input signal and digital output signal; 2) Communication applications and 3) Service applications.

Applications belonging to the first group use the digital pen and a writing surface with a position-coding pattern principally for inputting of information to a computer, a PDA or a mobile phone.

A product with a writing surface, for example a notepad, can be provided on the actual writing surface with a position-coding pattern taken from a first region, which pattern codes coordinates for points within a main region which is dedicated to notes, such as the main region 101 in Fig. 2. The product can also be provided with a box which is marked "store" and contains a posi-

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tion-coding pattern from a second main region which is
dedicated to commands, such as the main region 104 in
Fig. 2.

When the user writes on the writing surface, the pen
5   records a representation of what is written in the form
of a sequence of pairs of coordinates for points within
the first region on the imaginary surface by continually
recording images of that part of the position-coding
pattern which is within the field of view of the pen. The
10 pen stores these absolute coordinates in its buffer memo-
ry. When the user then places the pen in the box marked
"store" or ticks this box, the pen records coordinates
for at least one point in the main region 104 and stores
these in the buffer memory. At the same time the pen
15 notes that these coordinates represent a command. In the
pen's memory it is stored that precisely this command
(will be explained in greater detail below) means that
the information is to be stored in a nearby computer. As
soon as the pen starts communicating with the computer
20 with which it is synchronised, the pen transfers the
recorded coordinate information to the computer via its
transceiver. The computer stores the received information
as an image, which for example can be displayed directly
on the computer's screen. Searching the stored informa-
25 tion can be carried out afterwards on the basis of the
time of storing (or recording) the information and on the
basis of key words which were written in capital letters
on the writing surface and which could thus be stored in
character-coded format (ASCII) after character recogni-
30 tion (OCR).

Other commands which can be found on a product of
the type described above are, for example, "address
book", which is a box provided with a different subset
of the position-coding pattern which codes a subregion
35 of the main region 104, which subregion is dedicated to
an address book command. When the pen recognises the
coordinates for this command, it sends address informa-

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tion which was written by hand, for example in capital
letters, on a subset of the position-coding pattern
intended for this purpose to the computer which stores
the address information in a digital address book. Dif-
5 ferent subregions of the subregion dedicated to the
address book command on the imaginary surface can be
dedicated to different address information.

Information with a content which requires interpre-
tation in order for certain measures to be carried out
10 in the system is currently written preferably in capital
letters in special character recognition fields, so-
called "combs", which are provided with a subset of the
position-coding pattern which is dedicated to character
interpretation. This means that the user is caused to
15 write legible characters, which facilitates their inter-
pretation.

The communication applications, that is applica-
tions belonging to the second group above, are somewhat
more demanding. They also usually require access to the
20 Internet. Loose pages, pages in a calendar, a notebook or
the like can be designed as forms for the transmission of
graphical e-mail, SMS, fax or the like. Fields are print-
ed on the page which are intended for indication of
address, subject and message text. Address and subject
25 are intended to be written in capital letters so that
they can easily be converted into character-coded format
and can be understood by other digital units which are
designed for managing information in character-coded
format. The information in the message field can consist
30 of any graphical information. The page is also provided
with a tick box which, when it is ticked, causes the pen
to make contact via its transceiver with the mobile phone
with which it is synchronised. The mobile phone identi-
fies the message as a graphical e-mail message which is
35 intended for a predetermined server unit which is incor-
porated in the information management system. The identi-
fication can be carried out by means of information which

is stored in the pen, or in some unit with which the
mobile phone is in communication, while the mobile phone
preferably only functions as a link or a modem. The
mobile phone transfers the message to the base station by
5   the use of GSM or GPRS, etc, and then by means of TCP/IP
to the predetermined server unit which decodes the
address field and sends the message via the Internet to
the addressee. A confirmation of delivery can be sent to
the mobile phone and shown on its display.
10   The above-mentioned page can be provided with a sub-
set of the position-coding pattern which codes a main
region on the imaginary surface which is dedicated to
transmission of (graphical) e-mail. Different parts of
this main region can then represent the different fields
15   and the tick boxes. This type of hierarchical layout of
a main region will be described in greater detail below
with reference to Figs 5-6.
         Alternatively, the different fields and tick boxes
can be provided with different subsets of the position-
20   coding pattern which code coordinates for points within
main regions on the imaginary surface which are dedicated
to address information, subject indication, transmission,
etc. This type of general layout of main regions on the
imaginary surface will be described in greater detail
25   below with reference to Fig. 4. The advantage of using a
universal "send" box is that this can then be represented
by the same subset each time it is used, irrespective of
whether it is, for example, on a note sheet or on an
e-mail form. This is more economical with the available
30   imaginary surface. Another advantage is that the decoding
in the pen is simple, as the pen only needs to recognise
that it is a "send" box that has been ticked, whereupon
the pen is to initiate an operation.
         The service applications, that is those belonging
35   to the third group above, are applications where the
information management is controlled via one or more
predetermined server units. An example is an advertise-

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ment in a newspaper which is provided with a subset of
the position-coding pattern, which codes coordinates for
points within a main region on the imaginary surface
which is dedicated to information which is to be sent to
5   a predetermined server unit. This particular subset codes
coordinates for points within a particular subregion of
the main region, to which subregion the advertiser has
acquired the sole right. As is apparent from this, there
can thus be larger main regions on the imaginary surface
10   which are dedicated to a particular information manage-
ment purpose. These main regions can then be subdivided
into subregions to which different parties can have the
sole right. In the server unit, which in this example
also administers the main regions, it is noted which
15   party has the right to the different subregions. A subset
of the position-coding pattern can thus also make pos-
sible identification of an owner of the subregion within
which the pattern codes points.

In the case of the advertisement, a user can place
20   an order using his digital pen by specifying a recipient
address in the field intended for this and by ticking a
"send" box. If the order requires a payment to be made,
a credit card number can be given. If the order is for
the user, no recipient address needs to be given as an
25   address for the pen previously stored can be used. If the
order concerns a gift to another recipient, a handwritten
greeting to the recipient can be added in a writing area
for free-form graphical information in the advertisement.

When the user ticks the "send" box, the user unit 2
30   identifies that information was recorded within the main
region 104 and therefore sends the recorded information
to the predetermined server unit on the Internet. In the
server unit it is determined that the recorded informa-
tion is situated in a particular subregion, whereupon the
35   owner of this subregion is identified. Thereafter the
decoded information, together with any greeting, is sent

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to the owner who handles the delivery of the ordered pro-
duct or service.

Communication Between the Pen and External Units

Certain operations can be carried out in their
entirety by the pen itself, for example storing of a note
in the pen and input of information for a user program in
the pen. These operations can always be carried out by
the pen in stand-alone mode.

Other operations require communication with the out-
side world. These operations can be commenced in stand-
alone mode, but are not completed until the pen is con-
nected to the outside world. Alternatively, the opera-
tions can be carried out on line.

In local applications, for example recording of
notes or calendar notes, the pen communicates suitably
directly with a local unit, such as a computer, mobile
phone or PDA.

In communication and service applications, the pen
can transmit the recorded information, suitably together
with information about which operation is to be carried
out, to a nearby computer which, for example, arranges
the information as an e-mail message and sends this to
a predetermined address or to an address which is record-
ed by the pen. Alternatively, the pen can communicate
directly via its transceiver with a nearby external unit,
for example a fax machine, printer or the like, which is
also provided with a transceiver, in order to cause this
to carry out the required operation utilising the record-
ed information.

Alternatively, the pen can communicate via its
transceiver with a mobile phone, which acts as a modem
for the pen, for forwarding the recorded information to,
for example, a server unit, another mobile phone or a fax
machine.

As a further example, the pen can comprise or be
integrated in a mobile phone transceiver so that it can

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carry out the operations which require communication
directly.

    In the above, wireless transmission of information
from the pen is described. However, the transmission can
5   alternatively be via cables. For example, the user unit
2 can be connected via a cable to a network connection
unit, such as a mobile phone, a PDA, a computer or some
other suitable unit which has an interface to a computer
network, for example the Internet or a local company net-
10 work. Alternatively, the network connection unit can be
designed as a docking unit (not shown) which can be con-
nected via cables to a communication network, such as a
telephone network or a computer network. Such a docking
unit can advantageously be designed as a pen stand. When
15 the pen is placed in the docking unit, the pen is caused,
automatically or upon command, to communicate with the
outside world. The docking unit can also be designed to
charge the battery 15 (Fig. 3) in the pen. According to
another alternative, the docking unit is designed to
20 establish wireless connection with the outside world.

    The above communication can be achieved by a subset
of the position-coding pattern coding coordinates for
points within a main region on the imaginary surface
which is dedicated to the pen sending all the recorded
25 information, or parts thereof, to the external unit when
it detects coordinates within this main region. The pen
can be arranged to send information to the external unit
immediately or after a particular period of time. Alter-
natively, the pen can send the information after the
30 detection of a "send" box. The "send" box can, in this
case, be located within said main region, the pen storing
information which relates coordinates within this main
region to the address of the external unit, for example,
its Bluetooth® address.

35 Alternatively, as discussed above, the "send" box
can be located in a special command region, the "send"
box being allocated an instruction which causes the pen

to send information to the external unit. In this case,
no main region is required which is dedicated to sending
recorded information to the external unit, as the infor-
mation can, for example, be recorded in a writing field

5   whose position-coding pattern codes coordinates for
points within a main region which is dedicated to hand-
written notes, an address field whose position-coding
pattern codes coordinates for points within a main region
which is dedicated to OCR interpretation, etc. According-

10 ly, the pen only needs to store information which relates
coordinates within the "send" box or a subregion with
several different command boxes, to the address of the
external unit.

Information Processing in the System

15   The recorded information can be processed in the
system according to the invention. The processing can be
implemented in different parts of the system, depending
upon the application and/or capabilities of communication
with external units.

20   The recorded information can be finally processed in
the pen itself.

        Alternatively, only preliminary processing can be
carried out in the pen, such as decoding of a recorded
image into a pair of coordinates, compression of the

25 recorded information or conversion in the form of charac-
ter interpretation, translation, encryption, etc. The
recorded information can then be sent to a local unit for
processing in this, for example a local computer or a
PDA. The local unit can contain information about the

30 imaginary surface, or at least part thereof, and can be
designed in such a way that, in response to the receipt
of the recorded information, it identifies to which
region its coordinates belong and determines, based on
the region affiliation, how the information is to be

35 processed. Alternatively, the pen contains such informa-
tion about the imaginary surface, or a part thereof, that
it is able to identify to which region the coordinates

belong and to determine, based on the region affiliation,
how the information is to be processed. In this case, the
pen suitably sends a processing instruction to the local
unit.

5   The recorded information can alternatively be pro-
cessed by an external service provider that only has
information about its part of the imaginary surface. Such
an external service provider, which has the sole right to
a part (main region/subregion) of the imaginary surface

10   and does not have information about other parts, can, for
example, be a telecommunications operator which provides
communication services or a company which offers goods or
services via advertisements.

        The pen can contain information to the effect that a

15   particular part of the imaginary surface belongs to such
an external service provider, in which case the pen sends
the recorded information directly to this service pro-
vider for further processing.

        Alternatively, the pen can be designed to send the

20   recorded information to a predetermined central unit,
typically a server unit, which contains information about
all or parts of the imaginary surface. The central unit
can be arranged to identify, in response to the receipt
of the recorded information, to which region its coordi-

25   nates belong and to determine, based on the region affi-
liation, how the information is to be processed. The cen-
tral unit can then forward the information to the exter-
nal service provider. Alternatively, the central unit can
implement the service or communication application in

30   question.

        According to a further alternative, the pen can be
designed to send the recorded information, preferably
only one or a few pairs of coordinates thereof, to a
look-up unit, typically a server unit or a local compu-

35   ter, which contains information about all or parts of the
imaginary surface. In this embodiment, the look-up unit
is designed to identify, in response to the receipt of

information from the pen, to which region the received
information belongs and to return to the pen an address
for the external service provider which is allocated
the identified region. The pen is designed to send the
5   recorded information to this address for final process-
ing, in response to the receipt of the address.

Detailed Example of Imaginary Surface

        Fig. 4 shows schematically, in a similar way to
Fig. 2, an imaginary surface 200 which constitutes or is
10   made up by all the points or positions whose absolute
coordinates can be coded by a position-coding pattern. A
number of different main regions 201-206 are defined on
the imaginary surface 200. The main regions are in gene-
ral divided into subregions (not shown), which in turn
15   can be divided into further subregions, etc.

        In the discussion of the embodiment shown in Fig. 4
it is assumed that the total surface 200 is made up of
pairs of x-y-coordinates of binary type, that is consist-
ing of ones and zeros, where the pairs of coordinates
20   have a length of 36 bits for both the x-coordinate and
the y-coordinate. The position-coding pattern thus codes
coordinates which make up an imaginary surface with 4^{36}
points or positions. The number of positions in this
example can possibly be increased further by interpola-
25   tion.

        In the example according to Fig. 4, a "send" region
201 is dedicated to be used for the generation of "send"
commands from the digital pen. The "send" region can, for
example, be defined as all pairs of coordinates whose
30   x-value starts with 0001 and whose y-value starts with
0001. For example, the four first bits in a pair of coor-
dinates thus indicate its affiliation to a main region.
With a division according to this example, 256 main
regions are obtained.

35   In the example concerned, the four first bits thus
indicate the main region affiliation, and a particular
number of the last bits indicates the size of the sub-

regions in the main region. In the "send" region 201, the
size of the subregions 207 is the minimum, a so-called
atom, consisting of 64*64 positions or corresponding to
the six last bits. With a distance of approximately

5   0.3 mm between the dots in the position-coding pat-
tern, this corresponds to a pattern surface of appro-
ximately 20*20 mm^2. The other 26 bits (36 - 4 - 6)
address the different subregions 207 (corresponding
to a "send" box) in the "send" region. The total number

10   of subregions is then 4^{26}, that is over 4500 billion
(4 503 599 627 370 496). Each subregion 207 ("send" box)
can thereby be identified by a number which consists of
the 5th to the 30th bit of the x- and y-coordinates. The
four first bits in each recorded pair of coordinates thus

15   indicate in which main region the pen is situated, the
following 26 bits identify a subregion (for example, a
particular "send" box) within the main region, and the
six last bits indicate where in the subregion the pen is
situated.

20   These "send" boxes suitably belong to different
recipients in a network which is connected to an infor-
mation management system according to this invention.
Information about such affiliation is stored in the
information management system, either in the pen itself

25   or in an external unit communicating with the pen, such
as a local computer, a mobile phone or a server unit.
         The second main region 202 is dedicated to notepad
information and also comprises a large number of sub-
regions 208 (corresponding to writing fields). Informa-

30   tion about the position of these subregions 208 is pre-
ferably stored in a computer with which one or more pens
communicate, or in the pens themselves. The position of
the subregions 208 is predetermined, so that all users of
the system know in advance that notes made in these sub-

35   regions 208 belong to the main region 202 which is dedi-
cated to the notepad.

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For the notepad region 202 it is desirable that each subregion 208 (writing field) is larger than an A4 page, for example approximately 1 m² in size, corresponding to approximately 12 bits, to provide for essentially all
5   formats of notepad. The number of subregions 208 (writing fields) in the main region 202 for the notepad is thus equal to 4^{20}, that is approximately 1 billion (1 099 511 627 776).

The third main region 203 is dedicated to general
10   availability. Information about the position of this main region is stored in a server unit with which one or more pens communicate. No user can reserve any part of this main region for his own use. This main region can also be divided into subregions, but the user can also decide for
15   himself the sizes of the subregions.

The fourth main region 204 is, in contrast to the general main region 203, dedicated to giving the owner exclusive availability, that is the subregions are assumed only to be available for one pen at a time or in the
20   way determined by the owner. Information about the position of this main region 204 and its subregions is stored in a server unit with which one or more pens communicate. The fact that the owner can reserve parts of this main region for his own use means that collisions are avoided,
25   as two or more pens cannot simultaneously use an identical copy of the same part of the printed position-coding pattern which makes up this main region, or at least that the owner has full control over this.

A large number of private subregions in one or more
30   private main regions 205 can be regarded as subscription objects, that is they can be reserved for a user for a shorter or longer period of time. Information about the positions of the main regions 205 or their subregions can be stored, together with the identity of a pen, in
35   a server unit with which one or more pens communicate. In principle each person and each company in the world

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can have their own private area (subregion) with a size
of 1 m².

The sixth main region 206 is intended to be avail-
able for local management of communication between a pen
5   and a local computer, without necessarily having to be in
contact with a computer/server unit in a network. Since
the pen suitably communicates directly with the local
computer, the pen should contain information about the
position of this main region 206.

10 Of course, this can be achieved by the pen contain-
ing information about the division of all the imaginary
surface. It is, however, desirable to minimise the infor-
mation that must be stored in the pen, as this means
lower requirements for memory in the pen and greater
15 speed for its data processing.

A preferred structure for the main region 206
intended for local communication is shown in Fig. 5 and
described below. It must, however, be pointed out that
the structure described below can equally well be used
20 for service and communication applications, particularly
when there is a need for the pen to be able to carry out
operations itself on the recorded information and it must
therefore contain detailed information about the imagi-
nary surface.

25 In the embodiment according to Fig. 5, the main
region 206 is divided into subregions 210-213 which con-
tain basic elements in the form of pages 213. Each page
213 is a particular size and has a number of fields for
predefined information management, as will be described
30 in greater detail in connection with Fig. 6. For example,
each main region 206 can be divided into a number of sec-
tions 210, each of which is divided into a number of
shelves 211, each of which is divided into a number of
books 212, each of which contains the above-mentioned
35 pages 213. At a particular level within the subregions
210-212, all the pages 213 have an identical size and
layout. For example, the sections 210 can contain diffe-

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rent pages, while each section 210 contains shelves 211
and books 212 with identical pages 213. Alternatively,
each section's 210 shelves 211 can contain different
pages 213, while all books 212 within each shelf 211 have
5   identical pages 213. Alternatively, the different books
212 can contain different pages 213, while the pages
within each book 212 are identical. As a further alterna-
tive, the whole main region 206 can, of course, contain
identical pages 213 in all the subregions 210-212.

10   The embodiment with a large number of identical
pages permits the use of a simplified, preferably algo-
rithm-based, database in the pen's memory. The pen stores
a number of page templates, which define the size and
layout of the pages for the different subregions 210-212
15   in the main region 206. Such a page template can be allo-
cated to the highest subregion level which contains iden-
tical pages. With such a reduced database the pen can
independently and quickly calculate which information is
to be sent to the local computer, for example all infor-
20   mation which has been recorded on one or more pages.
Suitably each section, shelf, book and page has an iden-
tifying designation, for example a number. A particular
subregion, for example a page, can thus be addressed
simply by giving a sequence of numbers, as follows:
25   section.shelf.book.page. For example, 35.100.4.0 can be
interpreted as all the pages in book number 4 on shelf
number 100 in section number 35. In addition, the diffe-
rent fields on each page can be addressed in a corre-
sponding way: section.shelf.book.page.field.

30   Each section 210 can be dedicated to a particular
type of information management, for example notes,
calendar information, etc. Within each section one or
more shelves, books or pages can be allocated to an
owner. For example, a calendar manufacturer can lease
35   a shelf with 1024 books with 16384 pages of A9 format.

        Alternatively, each hierarchically organised main
region can be dedicated to a particular type of informa-

tion management, for example notepads, calendars, gra-
phical messages, etc, or for a particular owner. It is
realised that each such main region can be divided into
any number of subregion levels.

5   As mentioned above, each section 210, shelf 211,
book 212, page 213 or field can be allocated particular
properties. In addition to the above-mentioned layout of
the pages, these properties can, for example, indicate
how long the pen is to store information which has been

10   recorded without having been sent to an external unit,
for example the above-mentioned local computer. Other
properties can be that all recorded information is to be
sent to a predetermined address, for example a Bluetooth®
node, that all recorded information is to be character-

15   interpreted (ICR), that all recorded information is to be
sent directly, that is without the recording of a "send"
box.

        Each page 213 is coded by a subset of the position-
coding pattern, which subset is intended to be applied

20   onto the surface of the intended product. This subset can
be applied either continuously or discontinuously on the
surface of the product, as will be explained in greater
detail with reference to Fig. 6 which shows an example of
the layout of a page 213 on the imaginary surface. The

25   example shown is not restricted to recording of informa-
tion which is to be stored in a local computer, but also
makes possible communication and service applications.

        The page 213 in Fig. 6 is rectangular, and can thus
be identified by the coordinates for two opposite corner

30   points, C1, C2. The page 213 contains a number of fields
214-220 with completely or partially predetermined func-
tion.

        A central writing field 214 is dedicated to record-
ing of graphical information. ICR fields 215 are dedicat-

35   ed to character interpretation of the information record-
ed therein, where one or more ICR fields can be predefin-
ed to concern address information, for example an e-mail

address, a fax number or a street address or can be dedi-
cated to decoding only numbers or only letters. "Send"
boxes 216 are dedicated to initiating sending of recorded
information, where certain "send" boxes can have pre-

5   defined properties, for example initiating the sending of
an e-mail message, a fax message or an SMS message. If a
general "send" box 216 is used, this can instead be allo-
cated service selection fields 216', which indicate the
different "transport systems" that can be used, for exam-

10   ple e-mail, fax or SMS. Local command fields 217 are
dedicated to initiating operations in the pen's memory,
for example to delete all previously recorded information
on the page in question from the pen's memory, to com-
press existing information in the pen's memory, to insert

15   a bookmark in order to make possible the recreation of
the sequence of coordinates which was recorded in the
writing field when the bookmark was recorded, or to show
previously recorded information on the page in question
on a display, for example on a mobile phone or a local

20   computer. The property field 218 is dedicated to initiat-
ing sending of information stored in the pen to an exter-
nal unit, for example a local computer or a server unit.
Such a property field 218 can, for example, initiate
sending of the user's credit card number, postal address,

25   e-mail address, etc. General command fields 219 are dedi-
cated to initiating operations which are common to many
different applications, for example, that the information
which is to be sent is to be encrypted or allocated a
particular priority, or that the information recorded in

30   the writing field 214 is to be given certain visual pro-
perties, for example regarding colour, line thickness or
line type, which is reproduced when the information
recorded in the writing field 214 is displayed, for exam-
ple on a computer screen, or when it is printed out. A

35   signature field 220 is dedicated to recording pairs of
coordinates, the angle between the pen and the base, the
rotation of the pen and the pressure on the base.

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In the example above, the page 213 thus contains a plurality of message fields, such as writing field 214, ICR field 215 and signature field 220, a plurality of command fields, such as "send" boxes 216, local command
5. fields 217, property fields 218 and general command fields 219, and a plurality of selection fields 216', for example for choice of service.

The pen can, as mentioned above, store information about the page 213 in the form of an algorithm-based page
10 template. More specifically, the different fields 214-220 can be identified as one or more positions on the page 213. For example, each "send" box can have a particular extent and can be located in a particular position on each page 213. Similarly, each ICR field can have a par-
15 ticular extent and a particular position on each page 213.

An advantage of this type of hierarchical structure is that the pen can identify and initiate the operations which are indicated by the above fields 214-220 indepen-
20 dently and simply. Thus the result of these operations can be shown to the user on a display, for example on a mobile phone, a computer or on or in association with the pen itself. The user has thus the opportunity to confirm that the result is correct before the recorded informa-
25 tion is managed further in the system.

The owner of a particular page, book or shelf has the opportunity to design a product surface with a position-coding pattern, based on a page of the above-mentioned type. This can be carried out in two different
30 ways.

The product surface can be constructed of a position-coding pattern which has a discontinuous layout. This can be regarded as if all or parts of the different fields 214-220 on the above page 213 are "cut out" and
35 arranged into a required appearance. The actual location of the fields on the product surface is thus not related to the position of the fields on the imaginary surface,

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as different subsets of the position-coding pattern on
the surface of the product are taken from different parts
of the imaginary surface.

Such a discontinuous layout makes possible any plac-
5   ing and dimensioning of different fields on the surface
of the product, as position-coding patterns which code
parts of a "send" box, a writing field, etc, can be
located anywhere on the surface of the product. This case
is analogous with what was described above in connection
10   with the command regions in Figs 2 and 4.

The surface of the product can alternatively be con-
structed of a position-coding pattern which has a conti-
nuous layout. This can be regarded as if a part of the
above page is "cut out" to create a finished layout, so
15   that the whole surface of the product is provided with
a position-coding pattern which codes coordinates for
a continuous coordinate area on the imaginary surface.
Three such layouts are indicated in Fig. 6 by broken
lines. The reference A concerns a notepad page, the
20   reference B concerns a note sheet of the type which is
marketed under the trademark "Post-It", and the reference
C concerns a form for sending any graphical message.

The continuous position-coding pattern is preferable
in certain situations. The discontinuous layout of the
25   position-coding pattern often requires the boundary
between adjacent fields on the surface of the product to
have no position-coding pattern for a certain distance,
typically approximately 1 mm, so that the subsets which
code coordinates on each side of the boundary can be
30   detected unambiguously. Such boundary areas without posi-
tion-coding pattern can be undesirable, particularly when
the product is small. In these cases a continuous layout
of the position-coding pattern can be preferable.

It must also be pointed out that when designing the
35   surface of the product, regardless of whether the pattern
layout is continuous or discontinuous, the owner can have

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the opportunity to define in detail what the properties
of each field are to be.

With both continuous and discontinuous layouts of
the position-coding pattern the advantage is obtained
5   that the information which is to be sent to the external
unit is defined by the corner points C1, C2 for the page
concerned. The pen can thus, automatically or upon com-
mand, send to the external unit all information which has
been recorded within the corner points C1, C2 on the ima-
10   ginary surface.

A person skilled in the art will realise that there
are many alternative ways of dividing the imaginary sur-
face. It is common to the embodiments described above
that different regions on the imaginary surface are dedi-
15   cated to different purposes. In this way both recording
of information and control of the management of informa-
tion can be carried out.

<u>APPENDIX</u>

In the following the description is reproduced of
a preferred position-coding pattern according to the
International Patent Application PCT/SE00/01895.

5   Fig. 7 shows a part of a product in the form of a
sheet of paper A1, which on at least part of its surface
A2 is provided with an optically readable position-coding
pattern A3 which makes possible position determination.

The position-coding pattern comprises marks A4,
10   which are systematically arranged across the surface A2,
so that it has a "patterned" appearance. The sheet of
paper has an X-coordinate axis and a Y-coordinate axis.,
The position determination can be carried out on the
whole surface of the product. In other cases the surface
15   which enables position determination can constitute a
small part of the product.

The pattern can, for example, be used to achieve an
electronic representation of information which is written
or drawn on the surface. The electronic representation
20   can be achieved while writing on the surface with a pen,
by continually determining the position of the pen on the
sheet of paper by reading off the position-coding pat-
tern.

The position-coding pattern comprises a virtual
25   raster, which is thus neither visible to the eye nor can
be detected directly by a device which is to determine
positions on the surface, and a plurality of marks A4,
each of which, depending upon its position, represents
one of four values "1" to "4" as described below. In this
30   connection it should be pointed out that for the sake of
clarity the position-coding pattern in Fig. 7 is greatly
enlarged. In addition, only a part of the sheet of paper
is shown.

The position-coding pattern is so arranged that the
35   position of a partial surface on the total writing sur-
face for any partial surface of a predetermined size is
determined unambiguously by the marks on this partial

surface. A first and a second partial surface A5a, A5b
are shown by broken lines in Fig. 7. The second partial
surface partly overlaps the first partial surface. The
part of the position-coding pattern (here 4*4 marks)
5   which is situated on the first partial surface A5a codes
a first position, and the part of the position-coding
pattern which is found on the second partial surface A5b
codes a second position. The position-coding pattern is
thus partly the same for the adjoining first and second
10   positions. Such a position-coding pattern is called
"floating" in this application. Each partial surface
codes a specific position.

Figs 8a-d show how a mark can be designed and how
it can be positioned relative to its nominal position
15   A6. The nominal position A6, which can also be called a
raster point, is represented by the intersection of the
raster lines A8. The mark A7 has the shape of a circular
dot. A mark A7 and a raster point A6 can together be said
to constitute a symbol.

20   In one embodiment, the distance between the raster
lines is 300 μm and the angle between the raster lines
is 90 degrees. Other raster intervals are possible, for
example 254 μm to suit printers and scanners which often
have a resolution which is a multiple of 100 dpi, which
25   corresponds to a distance between points of 25.4 mm/100,
that is 254 μm.

The value of the mark thus depends upon where the
mark is located relative to the nominal position. In the
example in Fig. 8 there are four possible locations, one
30   on each of the raster lines extending from the nominal
position. The displacement from the nominal position is
the same size for all values.

Each mark A7 is displaced relative to its nominal
position A6, that is no mark is located at the nominal
35   position. In addition, there is only one mark per nominal
position and this mark is displaced relative to its nomi-
nal position. This applies to the marks which make up the

pattern. There can be other marks on the surface which
are not part of the pattern and thus do not contribute
to the coding. Such marks can be specks of dust, uninten-
tional points or marks and intentional marks, from for
5   example a picture or figure on the surface. Because the
position of the pattern marks on the surface is so well-
defined, the pattern is unaffected by such interference.

In one embodiment, the marks are displaced by 50 μm
relative to the nominal positions A6 along the raster
10 lines A8. The displacement is preferably 1/6 of the
raster interval, as it is then relatively easy to deter-
mine to which nominal position a particular mark belongs.
The displacement should be at least approximately 1/8 of
the raster interval, otherwise it becomes difficult to
15 determine a displacement, that is the requirement for
resolution becomes great. On the other hand, the dis-
placement should be less than approximately 1/4 of the
raster interval, in order for it to be possible to deter-
mine to which nominal position a mark belongs.

20   The displacement does not need to be along the
raster line, but the marks can be positioned in separate
quadrants. However, if the marks are displaced along the
raster lines, the advantage is obtained that the distance
between the marks has a minimum which can be used to
25 recreate the raster lines, as described in greater detail
below.

Each mark consists of a more or less circular dot
with a radius which is approximately the same size as the
displacement or somewhat less. The radius can be 25% to
30 120% of the displacement. If the radius is much larger
than the displacement, it can be difficult to determine
the raster lines. If the radius is too small, a greater
resolution is required to record the marks.

The marks do not need to be circular or round, but
35 any suitable shape can be used, such as square or trian-
gular, etc.

Normally, each mark covers several pixels on a sensor chip and, in one embodiment, the centre of gravity of these pixels is recorded or calculated and used in the subsequent processing. Therefore the precise shape of the
5   mark is of minor significance. Thus relatively simple printing processes can be used, provided it can be ensured that the centre of gravity of the mark has the required displacement.

In the following, the mark in Fig. 8a represents the
10 value 1, in Fig. 8b the value 2, in Fig. 8c the value 3 and in Fig. 8d the value 4.

Each mark can thus represent one of the four values "1 to 4". This means that the position-coding pattern can be divided into a first position code for the x-coordi-
15 nate and a second position code for the y-coordinate. The division is carried out as follows:

Mark value	x-code	y-code
1	1	1
2	0	1
3	1	0
4	0	0

The value of each mark is thus converted into a
20 first value, here bit, for the x-code and a second value, here bit, for the y-code. In this way two completely independent bit patterns are obtained by means of the pattern. Conversely, two or more bit patterns can be combined into a common pattern which is coded graphi-
25 cally by means of a plurality of marks in accordance with Fig. 8.

Each position is coded by means of a plurality of marks. In this example, 4*4 marks are used to code a position in two dimensions, that is an x-coordinate and
30 a y-coordinate.

The position code is constructed by means of a number series of ones and zeros, a bit series, which has the

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characteristic that no four-bit-long bit sequence occurs
more than once in the bit series. The bit series is
cyclic, which means that the characteristic also applies
when the end of the series is connected to its beginning.
5   A four-bit sequence has thus always an unambiguously
determined position number in the bit series.

The bit series can be a maximum of 16 bits long if
it is to have the characteristic described above for bit
sequences of four bits. In this example, however, only a
10   seven-bit-long bit series is used, as follows:

"0 0 0 1 0 1 0".

This bit series contains seven unique bit sequences
of four bits which code a position number in the series
as follows:

15

Position number in the series	Sequence
0	0001
1	0010
2	0101
3	1010
4	0100
5	1000
6	0000

To code the x-coordinate, the bit series is written
sequentially in columns over all the surface which is to
be coded, where the left column K_0 corresponds to the
20   x-coordinate zero (0). In one column the bit series can
thus be repeated several times in succession.

The coding is based on differences or position dis-
placements between adjacent bit series in adjacent
columns. The size of the difference is determined by the
25   position number (that is the bit sequence) in the bit
series with which adjacent columns commence.

More specifically, if we take the difference Δ_n
modulo seven between, on the one hand, a position number
which is coded by a four-bit sequence in a first column

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K_n and which can thus have the value 0 to 6, and, on the
other hand, a position number which is coded by an adja-
cent four-bit sequence at a corresponding "height" in
an adjacent column K_{n+1}, the difference will be the same

5 regardless of where, that is at what "height", on the
two columns the difference is taken. Using the difference
between the position numbers for two bit sequences in two
adjacent columns, it is thus possible to code an x-coor-
dinate which is independent of and constant for all

10 y-coordinates.

As each position on the surface is coded by a par-
tial surface consisting of 4*4 marks in this example,
there are four vertical bit sequences available and thus
three differences, each with the value 0 to 6, for coding

15 the x-coordinate.

The pattern is divided into code windows F with
the characteristic that each code window consists of
4*4 marks. There are thus four horizontal bit sequences
and four vertical bit sequences available, so that three

20 differences can be created in the x-direction and four
position numbers can be obtained in the y-direction.
These three differences and four position numbers code
the position of the partial surface in the x-direction
and the y-direction. Adjacent windows in the x-direction

25 have a common column, see Fig. 7. Thus the first code
window $F_{0,0}$ contains bit sequences from the columns K_0, K_1,
K_2, K_3, and bit sequences from the rows R_0, R_1, R_2, R_3. As
differences are used in the x-direction, the next window
diagonally in the x-direction and y-direction, the window

30 $F_{1,1}$, contains bit sequences from the columns K_3, K_4, K_5,
K_6, and the rows R_4, R_5, R_6, R_7. Considering the coding in
just the x-direction, the code window can be considered
to have an unlimited extent in the y-direction. Corre-
spondingly, considering the coding in just the y-direc-

35 tion, the code window can be considered to have an
unlimited extent in the x-direction. Such a first and
second code window with unlimited extent in the y-direc-

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tion and x-direction respectively together form a code
window of the type shown in Fig. 7, for example $F_{0,0}$.

Each window has window coordinates F_x, which give
the position of the window in the x-direction, and F_y,
5   which give the position of the window in the y-direction.
Thus the correspondence between the windows and columns
is as follows:

$K_i = 3 F_x$

$R_i = 4 F_y$

10   The coding is carried out in such a way that for the
three differences, one of the differences Δ_0 always has
the value 1 or 2, which indicates the least significant
digit S_0 for the number which represents the position of
the code window in the x-direction, and the other two
15   differences Δ_1, Δ_2, have values in the range 3 to 6, which
indicates the two most significant digits S_1, S_2, for the
coordinate of the code window. Thus no difference can be
zero for the x-coordinates, as that would result in too
symmetrical a code pattern. In other words, the columns
20   are coded so that the differences are as follows:
(3 to 6); (3 to 6); (1 to 2); (3 to 6); (3 to 6); (1 to
2); (3 to 6); (3 to 6); (1 to 2); (3 to 6); (3 to 6); ...

Each x-coordinate is thus coded by two differences
Δ_1, Δ_2 of between 3 and 6 and a subsequent difference Δ_0
25   which is 1 or 2. By subtracting one (1) from the least
difference Δ_0 and three (3) from the other differences,
three digits are obtained, S_2, S_1, S_0, which in a mixed
base directly give the position number of the code window
in the x-direction, from which the x-coordinate can then
30   be determined directly, as shown in the example below.
The position number of the code window is:

$S_2 * (4*2) + S_1 * 2 + S_0 * 1$

Using the principle described above, it is thus pos-
sible to code code windows 0, 1, 2, ..., 31, using a posi-
35   tion number for the code window consisting of three
digits which are represented by three differences. These
differences are coded by a bit pattern which is based on

the number series above. The bit pattern can finally be
coded graphically by means of the marks in Fig. 8.

   In many cases, when a partial surface is inputted
consisting of 4*4 marks, a complete position number which
5   codes the x-coordinate will not be obtained, but parts of
two position numbers, as the partial surface in many
cases does not coincide with one code window but covers
parts of two adjacent code windows in the x-direction.
However, as the difference for the least significant
10 digit S_0 of each number is always 1 or 2, a complete
position number can easily be reconstructed, as it is
known what digit is the least significant.

   The y-coordinates are coded in accordance with
approximately the same principle as that used for the
15 x-coordinates by means of code windows. The cyclic num-
ber series, that is the same number series as is used for
the x-coding, is written repeatedly in horizontal rows
across the surface which is to be position coded. Pre-
cisely as for the x-coordinates, the rows are made to
20 start in different positions, that is with different bit
sequences, in the number series. For the y-coordinates,
however, differences are not used, but the coordinates
are coded by values which are based on the start position
of the number series in each row. When the x-coordinate
25 has been determined for a partial surface with 4*4 marks,
the start positions in the number series can in fact be
determined for the rows which are included in the y-code
for the 4*4 marks.

   In the y-code, the least significant digit S_0 is
30 determined by letting this be the only digit which has a
value in a particular range. In this example, one row of
four starts in position 0 to 1 in the number series, in
order to indicate that this row concerns the least sig-
nificant digit S_0 in a code window, and the three other
35 rows start in any of the positions 2 to 6 in order to
indicate the other digits S_1 S_2 S_3 in the code window. In

the y-direction there is thus a series of values as fol-
lows:

(2 to 6); (2 to 6); (2 to 6); (0 to 1); (2 to 6); (2 to
6); (2 to 6); (0 to 1); (2 to 6); ...

5   Each code window is thus coded by three values
between 2 and 6 and a subsequent value between 0 and 1.

        If zero (0) is subtracted from the low value and two
(2) from the other values, a position in the y-direction
S_3 S_2 S_1 S_0 in mixed base is obtained in a corresponding

10   way as for the x-direction, from which the position
number of the code window can be determined directly,
which is:

$$S_3 * (5*5*2) + S_2 * (5*2) + S_1 * 2 + S_0 * 1$$

        Using the method above, it is possible to code

15   $4 * 4 * 2 = 32$ position numbers in the x-direction
for the code windows. Each code window comprises bit
sequences from three columns, which gives $3 * 32 = 96$
columns or x-coordinates. In addition, it is possible
to code $5 * 5 * 5 * 2 = 250$ position numbers in the

20   y-direction for the code windows. Each such position
number comprises horizontal bit sequences from 4 rows,
which gives $4 * 250 = 1000$ rows or y-coordinates. In
total it is thus possible to code 96000 coordinate posi-
tions.

25   As the x-coding is based on differences, it is,
however, possible to select the position in which the
first number series in the first code window is to start.
If it is taken into account that this first number series
can start in seven different positions, it is possible to

30   code $7 * 96000 = 672000$ positions. The start position of
the first number series in the first column K_0 can be
calculated when the x- and y-coordinates have been deter-
mined. The above seven different start positions for the
first series can code different pages or writing surfaces

35   on a product.

        Theoretically, a partial surface with 4*4 symbols,
which each have four values, can code 4^{4*4} positions, that

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is 4,294,967,296 positions. In order to make possible
floating determination of the position of a partial sur-
face, there is thus a redundancy factor in excess of 6000
(4294967296/672000).

5   The redundancy consists partly in the restrictions
on the size of the differences, and partly in only 7 bits
out of 16 being used in the position code. This latter
fact can, however, be used to determine the rotational
position of the partial surface. If the next bit in the
10   bit series is added to the four-bit sequence, a five-bit
sequence is obtained. The fifth bit is obtained by read-
ing off the adjacent bit immediately outside the partial
surface which is being used. Such an additional bit is
usually easily available.

15   The partial surface which is read off by the sensor
can have four different rotational positions, rotated
through 0, 90, 180 or 270 degrees relative to the code
window. In those cases where the partial surface is
rotated, the reading off of the code will, however, be
20   such that the code read off will be inverted and reversed
in either the x-direction or the y-direction or both, in
comparison to if it had been read off at 0 degrees. This
assumes, however, that a slightly different decoding of
the value of the marks is used according to the table
25   below.

Mark value	x-code	y-code
1	0	0
2	1	0
3	1	1
4	0	1

The above-mentioned five-bit sequence has the char-
acteristic that it only occurs the right way round and
30   not in inverted and reversed form in the seven-bit
series. This is apparent from the fact that the bit
series (0 0 0 1 0 1 0) contains only two "ones". There-

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fore all five-bit sequences must contain at least three
zeros, which after inversion (and any reversing) result
in three ones, which cannot occur. Thus if a five-bit
sequence is found which does not have a position number
5   in the bit series, it can be concluded that the partial
surface should probably be rotated and the new position
tested.

In order to further illustrate the invention
according to this embodiment, here follows a specific
10   example which is based on the described embodiment of the
position code.

Fig. 9 shows an example of an image with 4*4 marks
which are read off by a device for position determina-
tion.

15   These 4*4 marks have the following values:

4 4 4 2
3 2 3 4
4 4 2 4
1 3 2 4

20   These values represent the following binary x- and
y-codes:

x-code: y-code:
0 0 0 0   0 0 0 1
1 0 1 0   0 1 0 0
25   0 0 0 0   0 0 1 0
1 1 0 0   1 0 1 0

The vertical bit sequences in the x-code code the
following positions in the bit series: 2 0 4 6. The dif-
ferences between the columns are -2 4 2, which modulo 7
30   gives: 5 4 2, which in mixed base codes the position
number of the code window: (5-3) * 8 + (4-3) * 2 + (2-1)
= 16 + 2 + 1 = 19. The first coded code window has the
position number 0. Thus the difference which lies in the
range 1 to 2 and which appears in the 4*4 marks of the
35   partial surface is the twentieth such difference. As
additionally there are in total three columns for each
such difference and there is a start column, the verti-

cal sequence furthest to the right in the 4*4 x-code
belongs to the 61st column (column 60) in the x-code
(3 * 20 + 1 = 61) and the vertical sequence furthest to
the left belongs to the 58th column (column 57).

5   The horizontal bit sequences in the y-code code the
positions 0 4 1 3 in the number series. As these horizon-
tal bit sequences start in the 58th column, the start
position of the rows is these values minus 57 modulo 7,
which gives the start positions 6 3 0 2. Converted to

10   digits in mixed base, this becomes 6-2, 3-2, 0-0, 2-2 =
4 1 0 0, where the third digit is the least significant
digit in the number concerned. The fourth digit is then
the most significant digit in the next number. It must
in this case be the same as in the number concerned.

15   (The exception is when the number concerned consists of
highest possible digits in all positions. Then it is
known that the commencement of the next number is one
larger than the commencement of the number concerned.)

        The position number is in mixed base 0*50 + 4*10 +

20   1*2 +0*1 = 42.

        The third horizontal bit sequence in the y-code thus
belongs to the 43rd code window which has a start posi-
tion 0 or 1, and as there are four rows in total for each
such code window, the third row is number 43*4=172.

25   In this example, the position of the top left corner
of the partial surface with 4*4 marks is (58,170).

        As the vertical bit sequences in the x-code in the
4*4 group start at row 170, the whole pattern's x-columns
start in the number series' positions ((2 0 4 6) -169)

30   mod 7 = 1 6 3 5. Between the last start position (5) and
the first start position the numbers 0-19 are coded in
mixed base, and by adding the representations of the
numbers 0-19 in mixed base the total difference between
these columns is obtained. A primitive algorithm for

35   doing this is to generate these twenty numbers and
directly add their digits. Call the sum obtained s. The
page or writing surface is then given by (5-s)modulo7.

An alternative method for determining which bit is
the least significant in a partial surface, in order to
be able to identify a code window in this way, is as
follows. The least significant bit (LSB) is defined as
5   the digit which is the lowest in a partial surface's
differences or row position number. In this way, the
reduction (redundancy) of the maximum useable number of
coordinates is relatively small. For example, the first
code windows in the x-direction in the example above can
10   all have LSB=1 and other digits between 2 and 6, which
gives 25 code windows, the next can have LSB=2 and other
digits between 3 and 6, which gives 16 code windows, the
next can have LSB=3 and other digits between 4 and 6,
which gives 9 code windows, the next can have LSB=4 and
15   other digits between 5 and 6, which gives 4 code windows,
the next can have LSB=5 and other digits 6, which gives 1
code window, that is a total of 55 code windows, compared
to 32 in the example above.
        In the example above, an embodiment has been
20   described where each code window is coded by 4*4 marks
and a number series with 7 bits is used. This is, of
course, only one example. Positions can be coded by more
or fewer marks. There does not need to be the same number
in both directions. The number series can be of different
25   lengths and does not need to be binary, but can be based
on a different base, for example hex code. Different num-
ber series can be used for coding in the x-direction and
coding in the y-direction. The marks can represent diffe-
rent numbers of values. The coding in the y-direction can
30   also be carried out by differences.
        In a practical example, a partial surface is used
consisting of 6*6 marks and where the bit series as a
maximum can consist of 2^6 bits, that is 64 bits. However,
a bit series consisting of 51 bits is used, and conse-
35   quently 51 positions, in order to have the possibility
of determining the rotational position of the partial
surface. An example of such a bit series is:

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0 0 0 0 0 1 1 0 0 0 1 1 1 1 1 0 1 0 1 0 1 1 0 1 1 0 0 1 1
0 1 0 0 0 1 0 1 0 0 1 1 1 0 1 1 1 1 0 0 1 0

Such a partial surface consisting of six by six
marks can code 4^{6*6} positions, which with the above raster
5   dimensions of 0.3 mm is an extremely large surface.

In a similar way as described above for the seven-
bit series, according to this invention the characteris-
tic is utilised that the partial surface is enlarged to
include one bit on each side of the partial surface, at
10   least at its centre, so that for the third and fourth
rows in the partial surface of 6*6 symbols, 8 symbols are
read off, one on each side of the partial surface, and .
similarly in the y-direction. The above-mentioned bit
series which contains 51 bits has the characteristic that
15   a bit sequence of 6 bits occurs only once and that a bit
sequence of 8 bits which contains said bit sequence of
6 bits occurs only once and never in an inverted position
or reversed and inverted. In this way, the rotational
position of the partial surface can be determined by
20   reading off 8 bits in row 3, row 4, column 3 and/or
column 4. When the rotational position is known, the
partial surface can be rotated to the correct position
before the processing is continued.

It is desirable to obtain a pattern which is as
25   random as possible, that is where areas with excessive
symmetry do not occur. It is desirable to obtain a pat-
tern where a partial surface with 6*6 marks contains
marks with all the different positions in accordance with
Figs 8a to 8d. In order to increase the randomness fur-
30   ther or avoid repetitive characteristics, a method can
be used which is called "shuffle". Each bit sequence in
a code window starts in a predetermined start position.
However, it is possible to displace the start position in
the horizontal direction for each row, if the displace-
35   ment is known. This can be carried out by each least sig-
nificant bit (LSB) being allocated a separate displace-
ment vector for the adjacent rows. The displacement vec-

tor states by how much each row is displaced in the horizontal direction. Visually it can be regarded as if the y-axis in Fig. 7 is "spiky".

In the example above, with a 4*4 code window, the displacement vector can be 1, 2, 4, 0 for LSB=0 and 2, 2, 3, 0 for LSB=1. This means that after subtracting the numbers 2 and 0 respectively, the above displacement is to be subtracted (modulo five) from the bit sequence's position number, before the calculating continues. In the example above, for the y-coordinate, the digits 4 1 0 0 (S_2, S_1, S_0, S_4) are obtained in mixed base, where the second digit from the right is the least significant digit, LSB. As the displacement vector 1, 2, 4, 0 is to be used (LSB=0) for the digits 4 and 1, 2 is subtracted from 4 to give $S_2=2$ and 4 is subtracted from 1 (modulo five) to give $S_1=2$. The digit $S_0=0$ remains unchanged (the displacement vector's component for the least significant digit is always zero). Finally, the digit S_4 belongs to the next code window, which must have LSB=1, that is the second displacement vector is to be used. Thus 2 is subtracted from 0 (modulo five) which gives $S_4=3$.

A similar method can be used to change the codes for the x-coordinates. However, there is less need to change the x-coordinates, as they are already relatively randomly distributed, as the difference zero is not used, in the example above.

In the example above, the mark is a dot. Naturally it can have a different appearance. It can, for example, consist of a line or an ellipse, which starts at the virtual raster point and extends from this to a particular position. Other symbols than a dot can be used, such as a square, rectangle, triangle, circle or ellipse, filled-in or not.

In the example above, the marks are used within a square partial surface for coding a position. The partial surface can be another shape, for example hexagonal. The marks do not need to be arranged along the raster lines

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in an orthogonal raster but can also have other arrange-
ments, such as along the raster lines in a raster with
60 degree angles, etc. A polar coordinate system can also
be used.

5   Rasters in the form of triangles or hexagons can
also be used. For example, a raster with triangles
enables each mark to be displaced in six different direc-
tions, which provides even greater possibilities, corre-
sponding to 6^{6*6} partial surface positions. For a hexago-
10 nal raster, a honeycomb pattern, each mark can be dis-
placed in three different directions along the raster
lines.

As mentioned above, the marks do not need to be dis-
placed along the raster lines but can be displaced in
15 other directions, for example in order to be located each
in a separate quadrant of a square raster pattern. In the
hexagonal raster pattern the marks can be displaced in
four or more different directions, for example in six
directions along the raster lines and along lines which
20 make 60 degrees with the raster lines.

In order for the position code to be detected, it is
necessary for the virtual raster to be determined. This
can be carried out, in a square raster pattern, by exa-
mining the distance between the different marks. The
25 shortest distance between two marks must originate from
two adjacent marks with the values 1 and 3 in the hori-
zontal direction or 2 and 4 in the vertical direction, so
that the marks lie on the same raster line between two
raster points. When such a pair of marks has been detect-
30 ed, the associated raster points (the nominal positions)
can be determined using knowledge of the distance between
the raster points and the displacement of the marks from
the raster points. Once two raster points have been
located, additional raster points can be determined using
35 the measured distance to other marks and from knowledge
of the distance between the raster points.

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If the marks are displaced 50 μm along the raster
lines, which are a distance of 300 μm apart, the least
distance between two marks will be 200 μm, for example
between marks with the values 1 and 3. The next smallest
5   distance arises between, for example, marks with the
values 1 and 2, and is 255 μm. There is therefore a rela-
tively distinct difference between the least and the next
smallest distance. The difference in any diagonals is
also great. However, if the displacement is larger than
10   50 μm, for example more than 75 μm (1/4), diagonals can
cause problems and it can be difficult to determine to
which nominal position a mark belongs. If the displace-
ment is less than 50 μm, for example less than approxi-
mately 35 μm (1/8), the least distance will be 230 μm,
15   which does not give a very large difference to the next
distance, which is then 267 μm. In addition, the demands
on the optical reading off increase.

The marks should not cover their own raster point
and should therefore not have a larger diameter than
20   twice the displacement, that is 200%. This is, however,
not critical, and a certain overlapping can be permitted,
for example 240%. The least size is determined initially
by the resolution of the sensor and the demands of the
printing process used to reproduce the pattern. However,
25   the marks should not have a smaller diameter than appro-
ximately 50% of the displacement in practice, in order to
avoid problems with particles and noise in the sensor.

In the embodiment above, the raster is an orthogonal
grid. It can also have other forms, such as a rhombic
30   grid, for example with 60 degree angles, a triangular or
hexagonal grid, etc.

Displacement in more or less than four directions
can be used, for example displacement in three directions
along a hexagonal virtual raster. In an orthogonal raster
35   only two displacements can be used, in order to facili-
tate the recreation of the raster. However, a displace-

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ment in four directions is preferred, but six or eight directions are also possible.

In the embodiment above, the longest possible cyclic number series is not used. Thus a degree of redundancy is obtained, which can be used in various ways, for example to carry out error correcting, replace missing or hidden marks, etc.

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CLAIMS

1. A global information management system, which is
intended for management of information represented in the
form of absolute coordinates and which is based on use of
a position-coding pattern which defines an imaginary sur-
face (100; 200) consisting of all the positions whose
absolute coordinates the position-coding pattern has the
capacity to code, wherein at least two unique regions
(101-104; 201-213) are defined on the imaginary surface
(100;200), each of which is dedicated to a predetermin-
ed management of information, so that the management of
information represented by the absolute coordinates of at
least one position on the imaginary surface (100;200) is
carried out dependent upon the region affiliation of said
at least one position.

2. An information management system according to
claim 1, in which said information comprises a sequence
of positions on the imaginary surface (100;200), which
positions form message information, such as interrelated
lines.

3. An information management system according to
claim 1 or 2, in which at least one command region (104;
201, 207; 216-219) which represents an operation is
defined on the imaginary surface (100; 200), so that
detection of the absolute coordinates for a position
within this command region (104; 201, 207; 216-219)
results in initiation of said operation.

4. An information management system according to
claim 3, in which said operation is one of the operations
to store information, to send information and to convert
information.

5. An information management system according to
claim 2, 3 or 4, in which a primary region (206) on the
imaginary surface (100; 200) is dedicated to a predeter-
mined management of information and contains said at

least one command region (216-219) and at least one mes-
sage recording region (214, 215, 220), which is dedicated
to digital recording of a sequence of positions on the
imaginary surface (200), which positions form message
5   information, such as interrelated lines.

6. An information management system according to
claim 5, in which the primary region (206) contains a
plurality of identical standard regions (213), said at
least one message recording region (214, 215, 220) and
10   said at least one command region (216-219) being includ-
ed in such a standard region (213).

7. An information management system according to any
one of the preceding claims, further comprising a com-
puter system (3) which is arranged to store information
15   about the division of the imaginary surface (100; 200)
into said regions.

8. An information management system according to
claim 7, in which the computer system (3) is arranged to
store information about an owner of at least one of said
20   regions.

9. An information management system according to any
one of the preceding claims, further comprising at least
one user unit (2) which is arranged to record said abso-
lute coordinates from a base (1) which is provided with
25   at least one subset of said position-coding pattern.

10. An information management system according to
claim 9, in which the absolute coordinates recorded by
means of the user unit (2) represent graphical informa-
tion which was written using the user unit (2) on said
30   at least one subset of the position-coding pattern.

11. An information management system according to
any one of the preceding claims, further comprising at
least one base (1) which is provided with at least one
subset of said position-coding pattern, said at least one
35   subset coding at least one position within at least one
region on the imaginary surface (100; 200).

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  12. An information management system intended for
management of digitally represented information which is
associated with absolute positions on an imaginary sur-
face (100; 200), wherein the imaginary surface (100; 200)
5 contains at least two regions (101-104; 201-213), each of
which is dedicated to predetermined management of said
information, so that the management of said information
is carried out dependent upon the region affiliation of
the absolute positions associated with said information.

10 13. An information management system according to
claim 12, in which at least one command region (104; 201,
207; 216-219) is defined on the imaginary surface (100;
200), which command region represents an operation, so
that detection of at least one absolute position within
15 said command region (104; 201, 207; 216-220) results in
initiation of said operation.

  14. An information management system according to
claim 13, in which said operation is one of the opera-
tions to store information, to send information and to
20 convert information.

  15. An information management system according to
any one of claims 12-14, comprising a computer system (3)
which is arranged to store information about which abso-
lute positions belong to a particular region.

25 16. An information management system according to
claim 15, in which the computer system (3) is arranged
to store information about an owner who is allocated at
least one of said regions.

  17. An information management system according to
30 any one of claims 12-16, further comprising a held-held
device (2) which is arranged to record at least one abso-
lute position on a base (1) which is provided with at
least one subset of said imaginary surface (100; 200).

  18. An information management system according to
35 claim 17, in which said at least one absolute position
which is recorded by the hand-held device (2) is asso-

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ciated with graphical information which was written with
the hand-held device (2) on the base (1).

19. An information management system according to
claim 17 or 18, in which a position-coding pattern is
5   arranged to define said at least one absolute position,
and in which the hand-held device (2) is arranged to
detect and decode the position-coding pattern to deter-
mine said at least one absolute position on the imaginary
surface (100; 200) and said region affiliation.

10   20. An information management system according to
claim 19, in which the position-coding pattern comprises
marks (A7) which are arranged with a displacement from
their nominal position (A6).

21. An information management system according to
15 any one of the preceding claims, further comprising at
least one base (1) whose surface is provided with at
least one subset of said imaginary surface (100; 200).

22. A database containing an imaginary surface (100;
200) which consists of positions defined by absolute
20 coordinates, wherein at least one position on the imagi-
nary surface (100; 200) is allocated a rule for informa-
tion management, so that information which is associated
with the absolute coordinates of said at least one posi-
tion is managed on the basis of said rule.

25   23. A database according to claim 22, in which the
imaginary surface (100; 200) consists of all the posi-
tions that a position-coding pattern has the capacity to
code.

24. A database according to claim 22 or 23, in which
30 the imaginary surface (100; 200) is divided into at least
two regions (101-104; 201-213) which are each allocated a
rule for information management.

25. A database according to any one of claims 22-24,
in which the imaginary surface (100; 200) comprises at
35 least one message recording region (101-103; 202-215,
220) which is allocated a rule for digital recording of
a sequence of positions on the imaginary surface (100;

200), which positions form message information, such as interrelated lines.

26. A database according to any one of claims 22-25, in which the imaginary surface (100; 200) comprises at
5 least one command region (104; 201, 207; 216-219) which is allocated a rule which represents an operation, so that detection of the absolute coordinates for a position within this command region (104; 201, 216-219) results in initiation of said operation.

10 27. A database according to claims 25 and 26, in which at least one message recording region (214, 215, 220) and at least one command region (216-219) are incorporated in a primary region (206) which is allocated a rule for predetermined information management.

15 28. A database according to claim 27, in which the primary region (206) contains a plurality of identical standard regions (213), said at least one message recording region (214, 215, 220) and said at least one command region (216-219) being incorporated in such a standard
20 region (213).

29. A database according to any one of claims 26-28, in which said operation is one of the operations to store information, to send information and to convert information.

25 30. A database according to any one of claims 22-29, which is stored completely or partially in a memory (21; 3') in a unit (2; 3) which is incorporated in an information management system.

31. A method for management of information which
30 is represented by absolute coordinates, comprising the step of defining at least two unique regions (101-104; 201-213), each of which is dedicated to predetermined information management, on an imaginary surface (100; 200) which consists of all the positions whose absolute
35 coordinates a position-coding pattern has the capacity to code, so that information which is represented by the absolute coordinates of at least one position on the ima-

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ginary surface (100; 200) is managed dependent upon the
region affiliation of said at least one position.

32. A method according to claim 31, further com-
prising the step of giving a party the sole right to use
.5   a subset of the position-coding pattern, which subset
codes at least one position within a predetermined region
(101-104; 201-220) on the imaginary surface (100; 200).

33. A method according to claim 31 or 32, comprising
the step of creating said information by moving a held-
10   held device (2) across a base (1) which is provided with
at least one subset of a position-coding pattern, which
subset codes absolute positions on the imaginary surface
(100; 200), said information being formed as a sequence
of absolute positions on the imaginary surface (100;
15   200), which absolute positions form message information,
such as interrelated lines.

34. A method according to any one of claims 31-33,
comprising the step of initiating an operation, when said
at least one position is situated within a command region
20   (104; 201, 216-219) on the imaginary surface (100; 200).

35. A method according to claims 33 and 34, in which
said operation concerns all or parts of the recorded mes-
sage information.

36. A method according to claim 34 or 35, in which
25   said operation is one of the operations to store informa-
tion, to send information and to convert information.

37. A method for management of digitally represented
information associated with at least one absolute posi-
tion on an imaginary surface (100; 200), which contains
30   at least two regions (101-104; 201-220), comprising the
steps of determining whether said at least one absolute
position, which is associated with said information, is
situated within one of said regions (101-104; 201-220)
and managing said information in a predetermined way
35   dependent upon to which region (101-104; 201-220) said
at least one absolute position belongs.

38. A method according to claim 37, comprising the steps of producing said information by moving a hand-held device (2) across a base (1) provided with a subset of said imaginary surface (100; 200), of determining the

5   absolute position of the hand-held device (2) during at least part of said movement and of associating said information with the absolute position thus determined.

39. A method according to claim 38, in which said information comprises a graph which represents said move-

10   ment.

40. A method according to claim 38, in which said information is characters which correspond to said movement after interpretation by means of a character interpretation program.

15   41. A method for compiling a pattern layout which is intended to be applied on a product (1) and which codes absolute positions on an imaginary surface (100; 200), which surface (100; 200) consists of all the absolute positions that a position-coding pattern has the capacity

20   to code and is divided into regions (101-104; 201-220), of which at least one first region is allocated a rule for how information which contains at least one position within the first region is to be managed, comprising the step of creating the pattern layout from at least one

25   subset of the position-coding pattern so that the pattern layout codes positions within said first region on the imaginary surface (100; 200).

42. A method according to claim 41, in which said at least one first region comprises a message recording

30   region (101-103; 202-215, 220) which is allocated a rule for digital recording of a sequence of positions on the imaginary surface (100; 200), which positions form message information, such as interrelated lines.

43. A method according to claim 41 or 42, in which

35   said regions (101-104; 201-220) comprise at least one second region, (104; 201, 216-219) which is allocated a rule which represents an operation, so that detection

of the absolute coordinates for a position within said
second region (104; 201, 216-219) results in initiation
of said operation.

44. A method according to claim 43, comprising the
step of creating the pattern layout to code positions
within one of a plurality of identical standard regions
(213) on the imaginary surface (100; 200), which stan-
dard region (213) contains said at least one first and
at least one second region (214-220).

45. A method according to any one of claims 41-44,
comprising the step of creating the pattern layout from
a single coherent subset of the position-coding pattern.

46. A method according to any one of claims 41-44,
comprising the step of creating the pattern layout by
combining at least two separate subsets of the position-
coding pattern.

47. A product which is intended to be used in a sys-
tem according to any one of claims 1-11, which product
(1) has a message field (1A) which is provided with a
first subset of the position-coding pattern to enable
digital recording of graphical information which is writ-
ten on said first subset, and a command field (1B) which
is provided with a second subset of the position-coding
pattern, which second subset defines an operation which
is to be carried out with regard to the recorded graphi-
cal information.

48. A product according to claim 47, in which the
first subset of the position-coding pattern in the mes-
sage field (1A) is continuous with the second subset of
the position-coding pattern in the command field (1B), so
that the product (1) is provided with a position-coding
pattern which codes positions within a coherent coordi-
nate area on the imaginary surface (100; 200).

49. A product according to claim 47, in which the
first subset of the position-coding pattern in the mes-
sage field (1A) is discontinuous with the second subset
of the position-coding pattern in the command field (1B),

by the first and second subsets coding positions within separate coordinate areas on the imaginary surface (100; 200).

50. Use of positions on an imaginary surface (100; 200) for control of management of information, which surface (100; 200) consists of a large number of positions and is divided into regions (101-104; 201-213), in which a rule is associated with each region (101-104; 201-213) for how the information which contains coordinates for at least one position within this region (101-104; 201-213) is to be managed.

51. Use according to claim 50, which comprises providing a product (1) with at least one subset of a position-coding pattern which codes a large number of positions on the imaginary surface (100; 200), which subset codes at least one position within at least one of said regions (101-104; 201-220).

52. Use according to claim 51, in which the imaginary surface (100; 200) consists of all the positions which the position-coding pattern has the capacity to code.
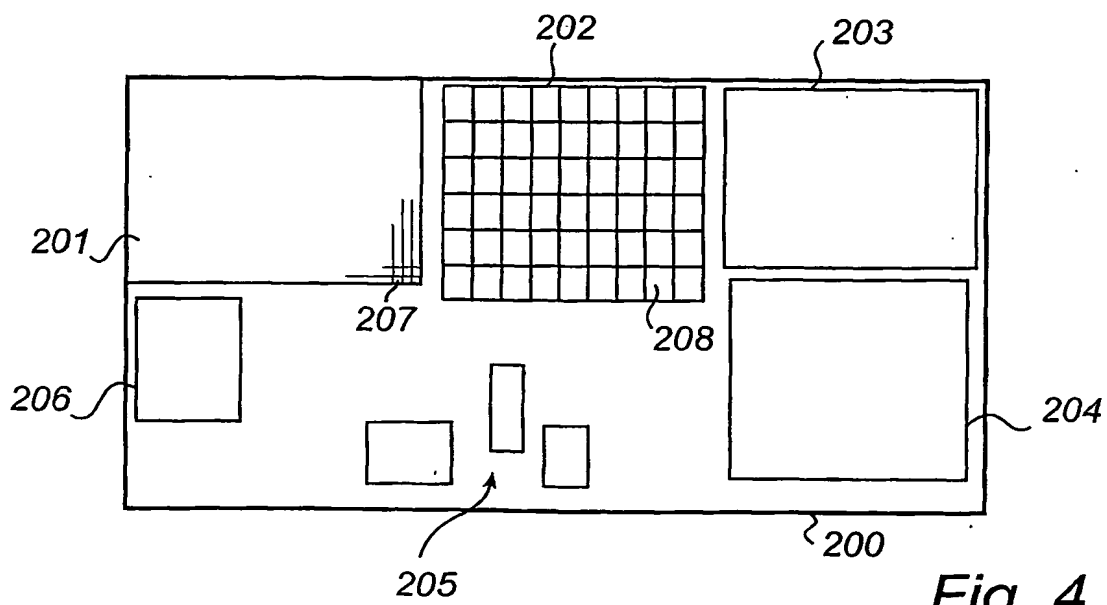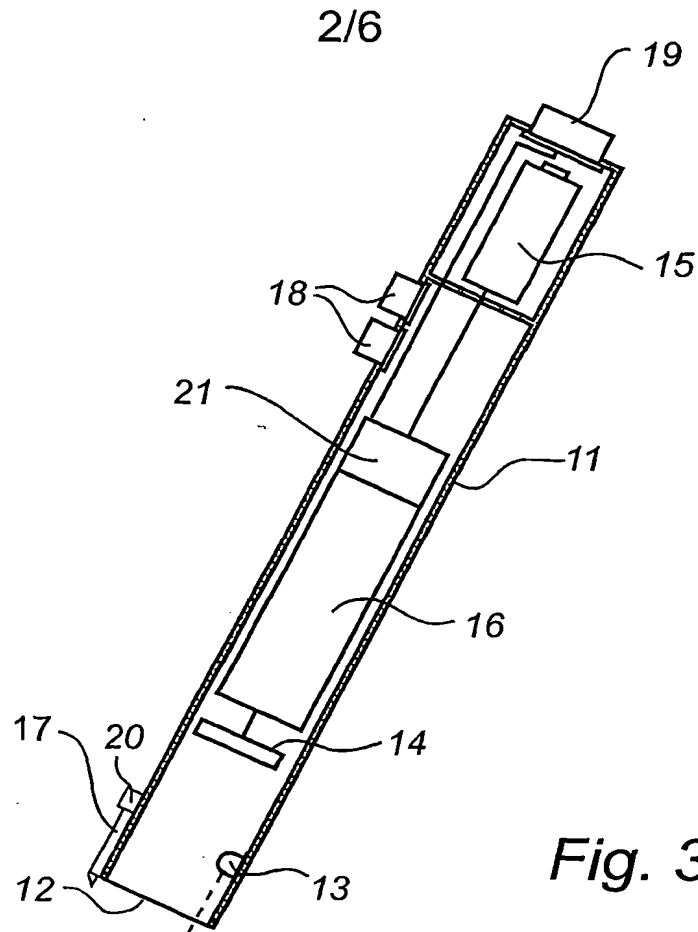
Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

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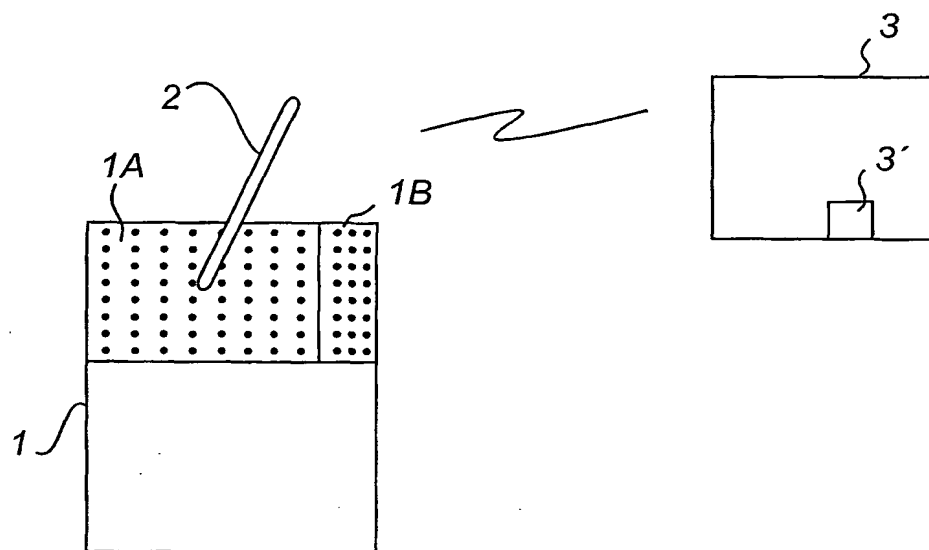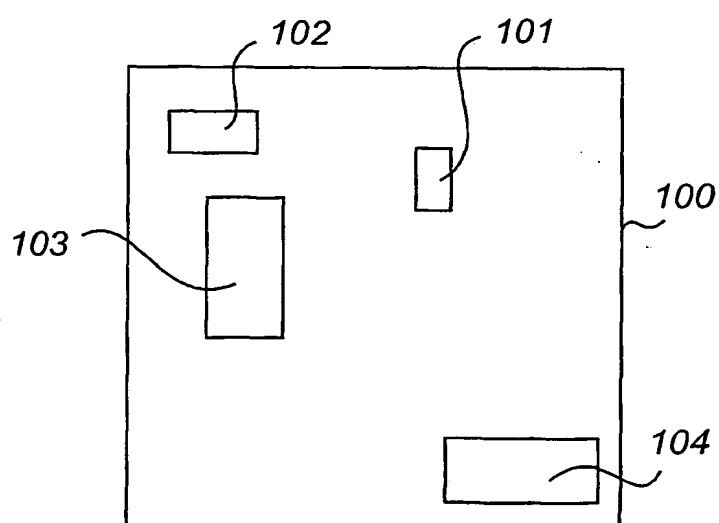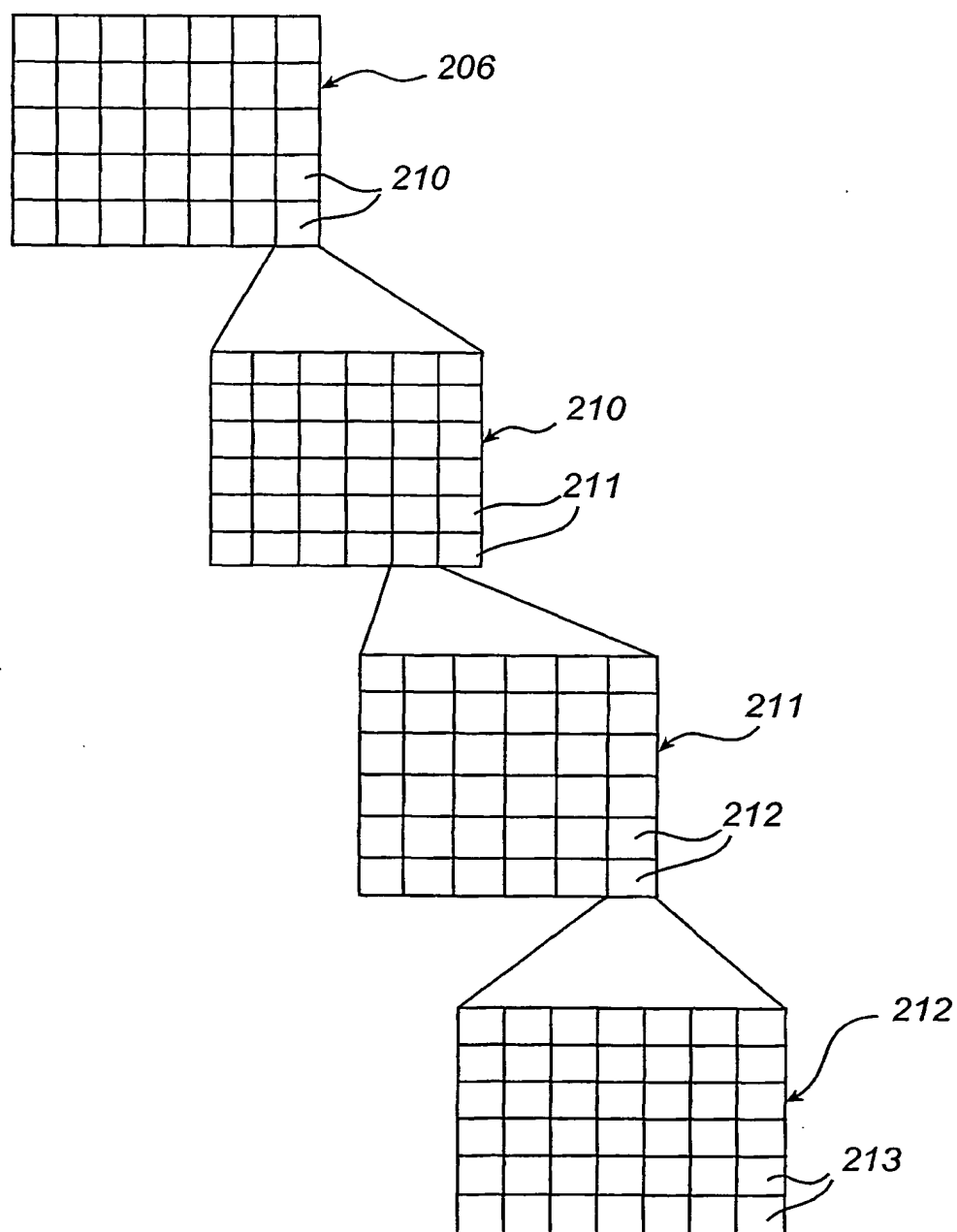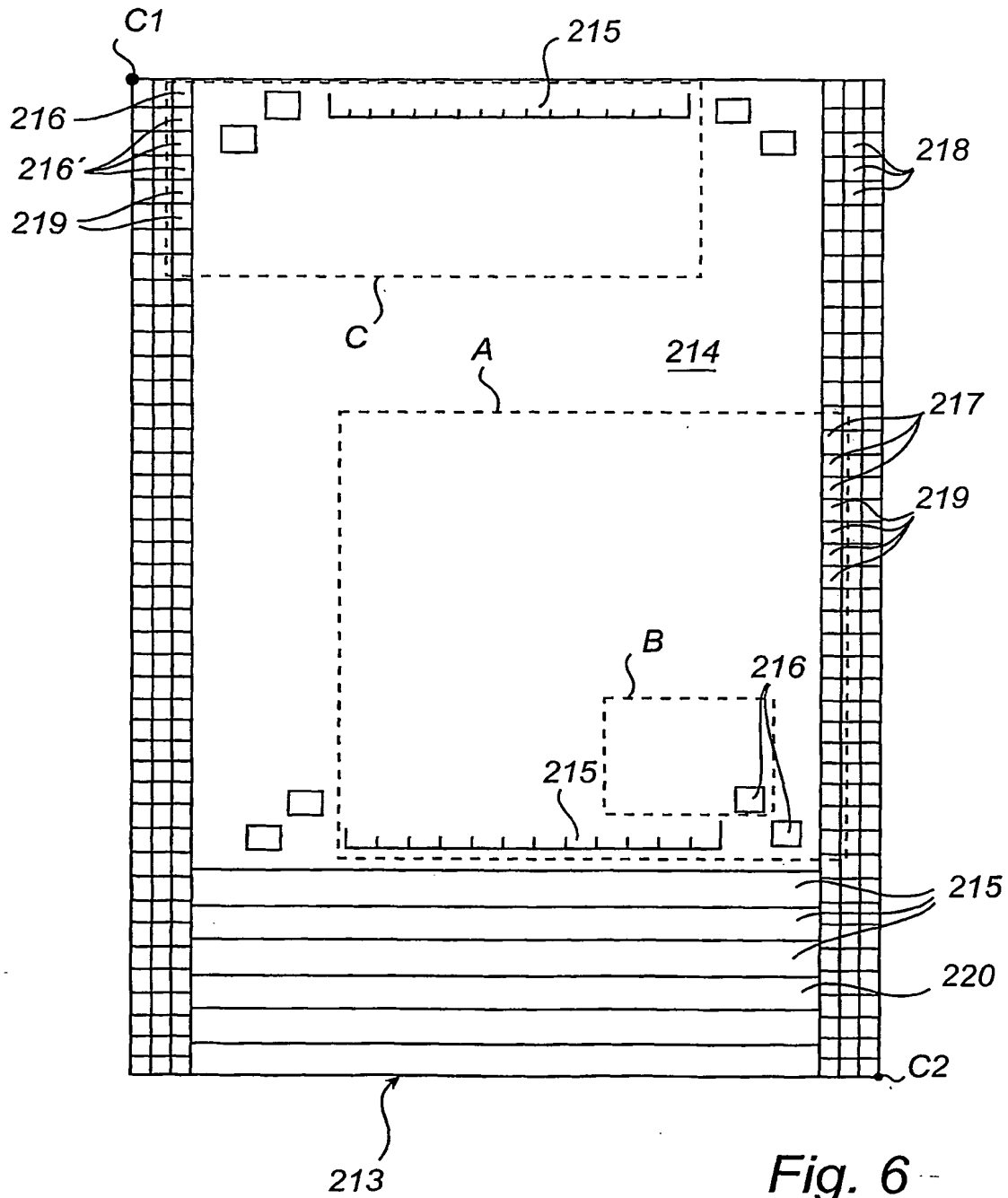
Fig. 6
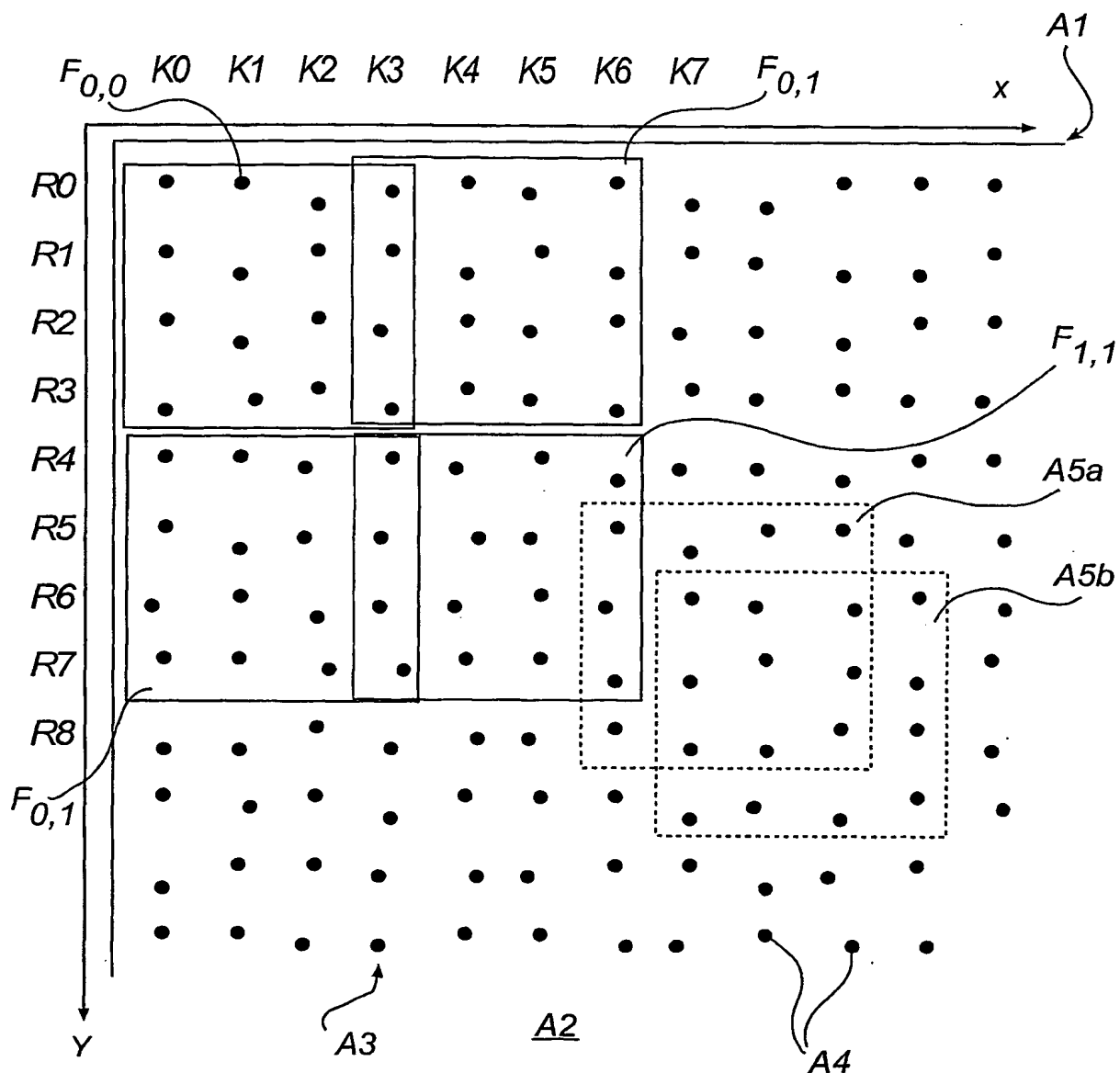
Fig. 7

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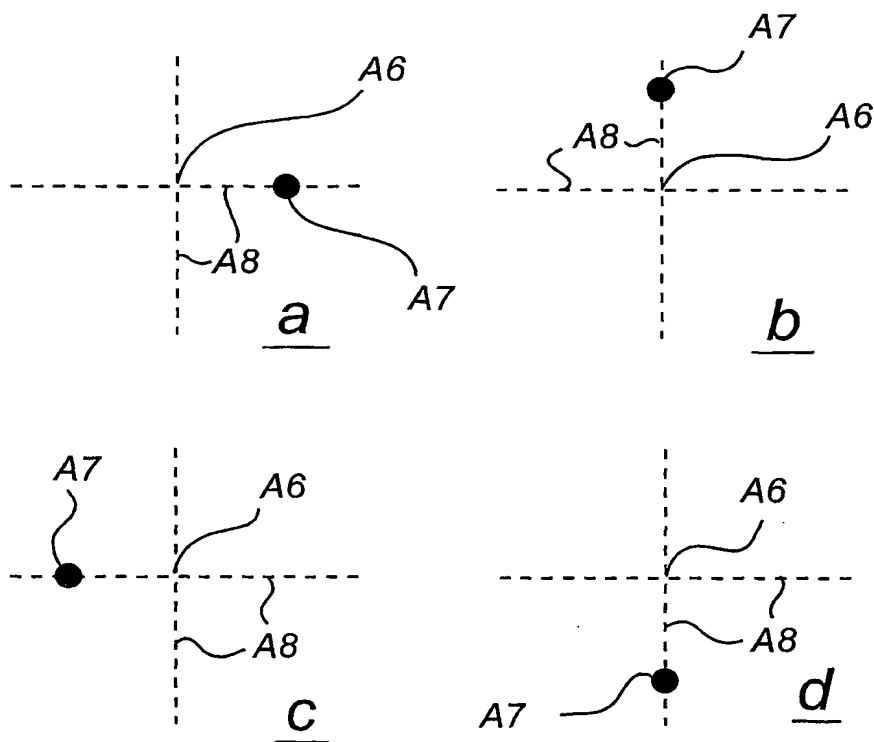
Fig. 8
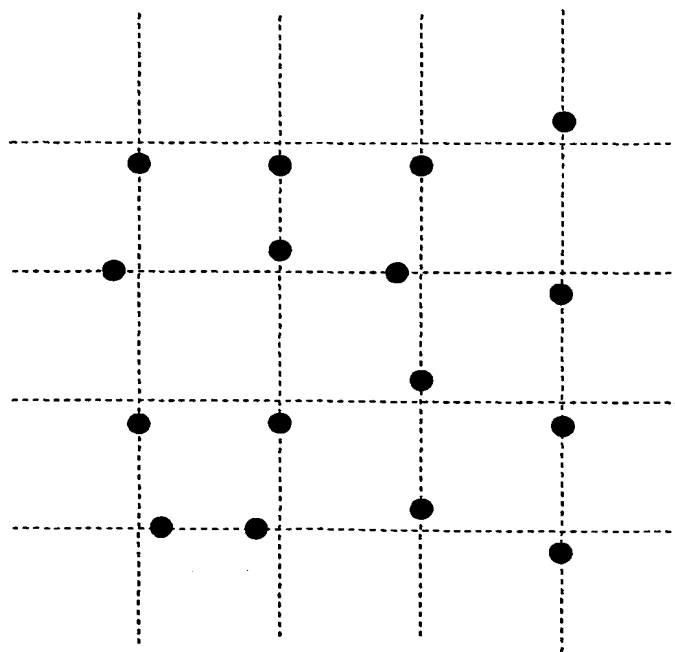
Fig. 9

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G06K 11/18, G06K 1/12, G06F 3/033

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06K, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI,EDOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5652412 A (M.LAZZOUNI ET AL), 29 July 1997 (29.07.97), column 2, line 36 – column 3, line 34; column 14, line 16 – line 33, claims 1,17,21, abstract	1-52
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X	WO 9956200 A1 (ALOP ELECTRONICS CO.,LTD.), 4 November 1999 (04.11.99), page 8, line 11 – page 10, line 3, figures 3a-b,4a-b, claims 1-9,12,16-19, abstract	1-52
	--	
X	US 5194852 A (E.S.MORE ET AL), 16 March 1993 (16.03.93), column 6, line 40 – column 7, line 28, figure 1, claim 1, abstract	1-52
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[X] Further documents are listed in the continuation of Box C.   [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
4 April 2001	0 6 -04- 2001

Name and mailing address of the ISA/	Authorized officer
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 2306669 A (RICOH COMPANY LTD.), 7 May 1997 (07.05.97), page 3, line 1 - page 4, line 3; page 6, line 1 - page 8, line 20; page 16, line 18 - page 17, line 12, page 23, line 5 - page 24, line 2; abstract	1-52
Y	US 5477012 A (O.F.SEKENDUR), 19 December 1995 (19.12.95), abstract	1-52
A	EP 0615209 A2 (KABUSHIKI KAISHA TOSHIBA), 14 Sept 1994 (14.09.94)	1-52

International application No.

PCT/SE 00/02659

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
US	5652412	A	29/07/97	NONE			
WO	9956200	A1	04/11/99	EP	1073948	A	07/02/01
US	5194852	A	16/03/93	EP	0416176	A,B	13/03/91
				US	4839634	A	13/06/89
GB	2306669	A	07/05/97	DE	19644109	A	07/05/97
				GB	9622632	D	00/00/00
				JP	9128137	A	16/05/97
				US	6081261	A	27/06/00
US	5477012	A	19/12/95	AU	4529896	A	14/07/97
				EP	0892971	A	27/01/99
				WO	9722959	A	26/06/97
				US	5852434	A	22/12/98
EP	0615209	A2	14/09/94	DE	69425520	D	00/00/00
				JP	6266490	A	22/09/94